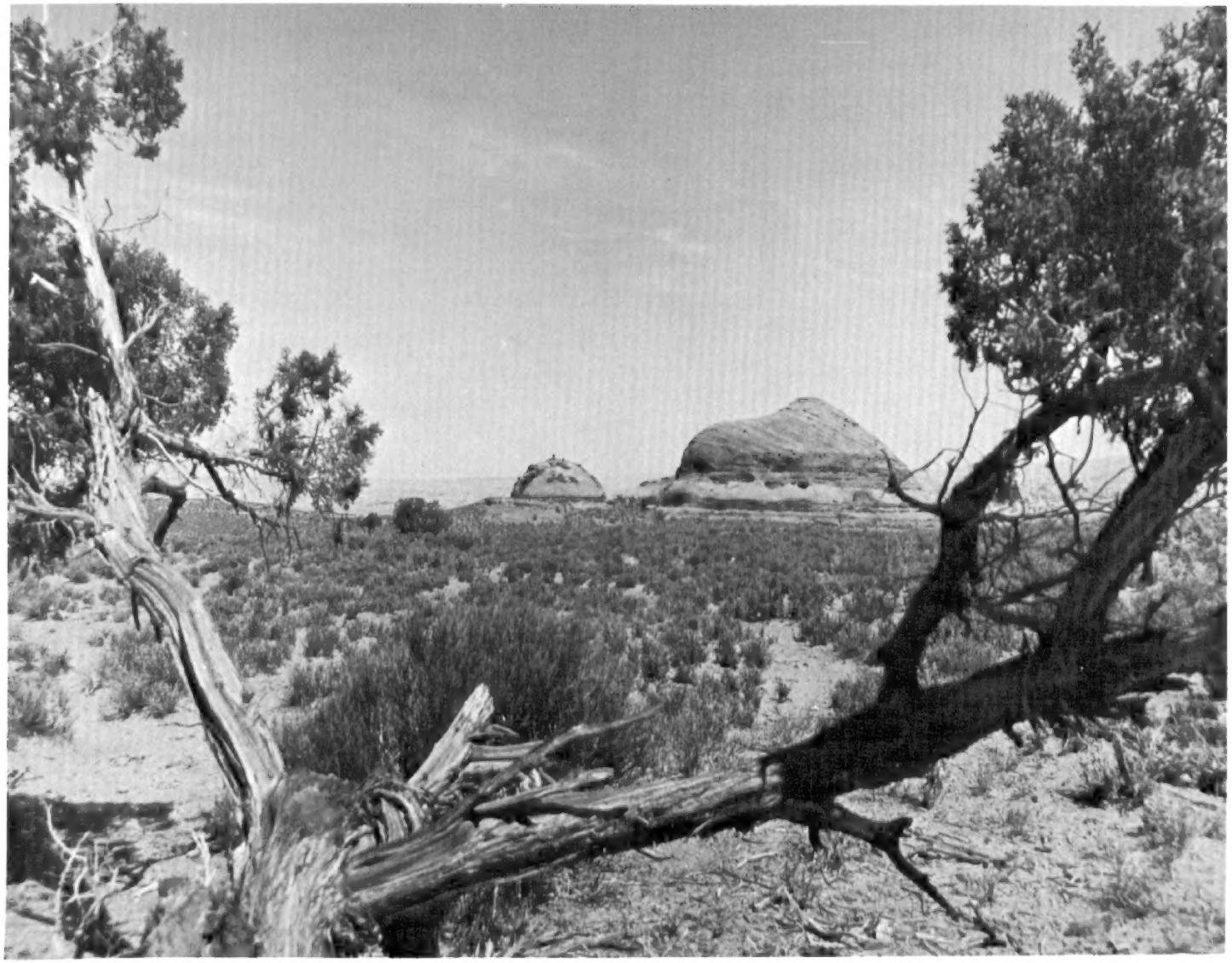
SOIL SURVEY OF

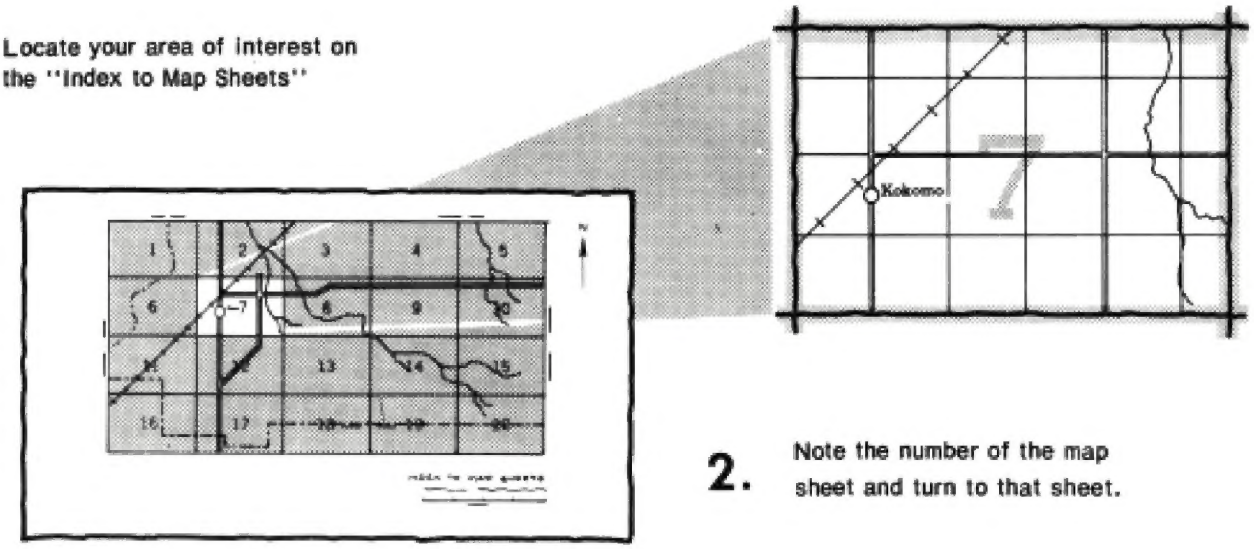
Navajo Indian Reservation San Juan County, Utah



United States Department of Agriculture
Soil Conservation Service
and
United States Department of the Interior
Bureau of Indian Affairs
in cooperation with the
Utah Agricultural Experiment Station

HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"



2. Note the number of the map sheet and turn to that sheet.

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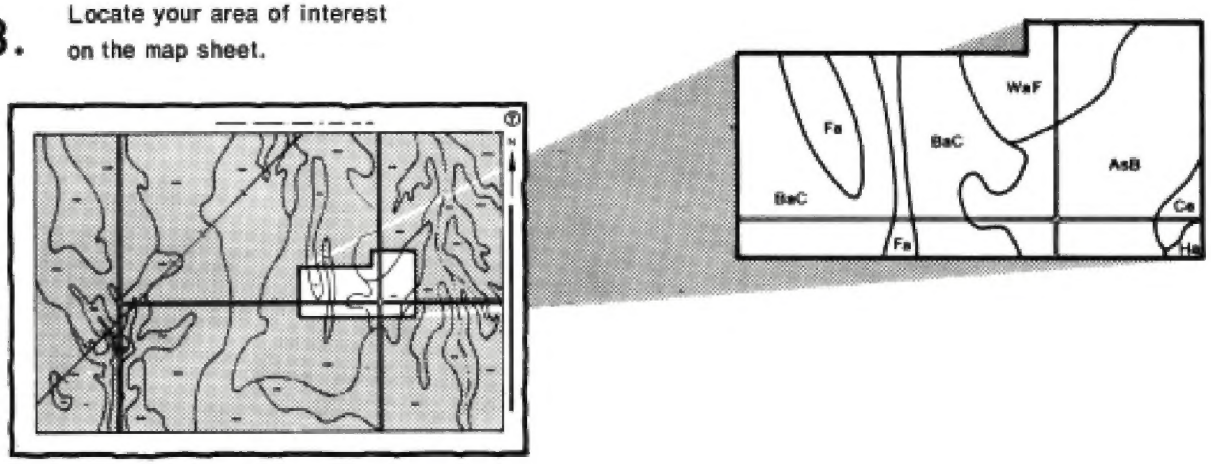

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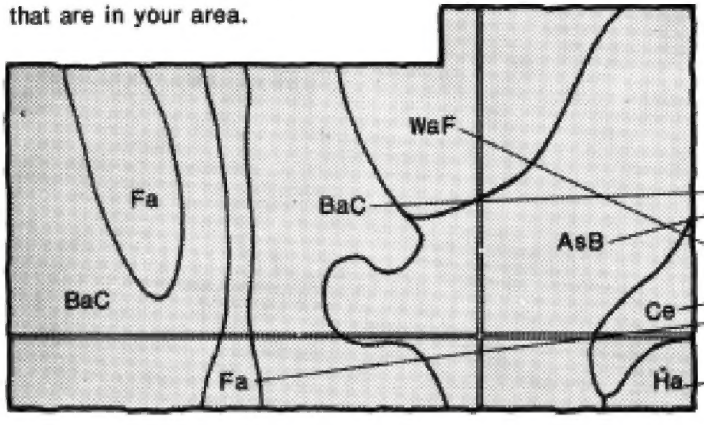

Symbols

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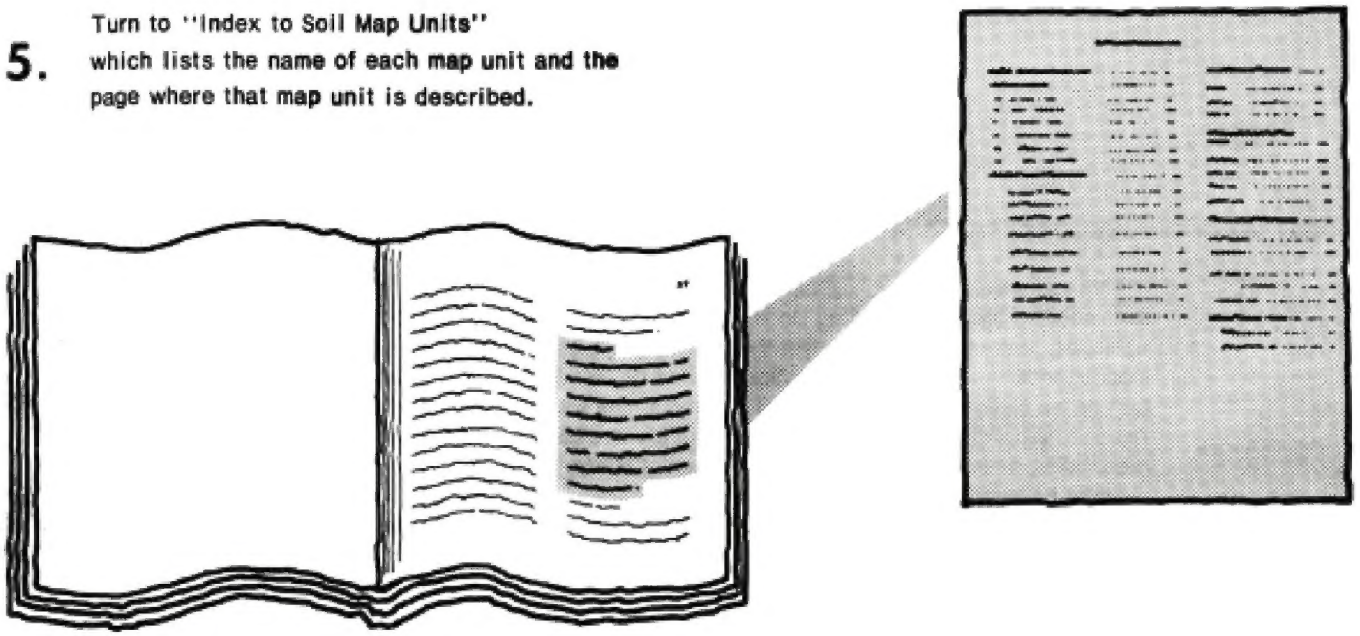
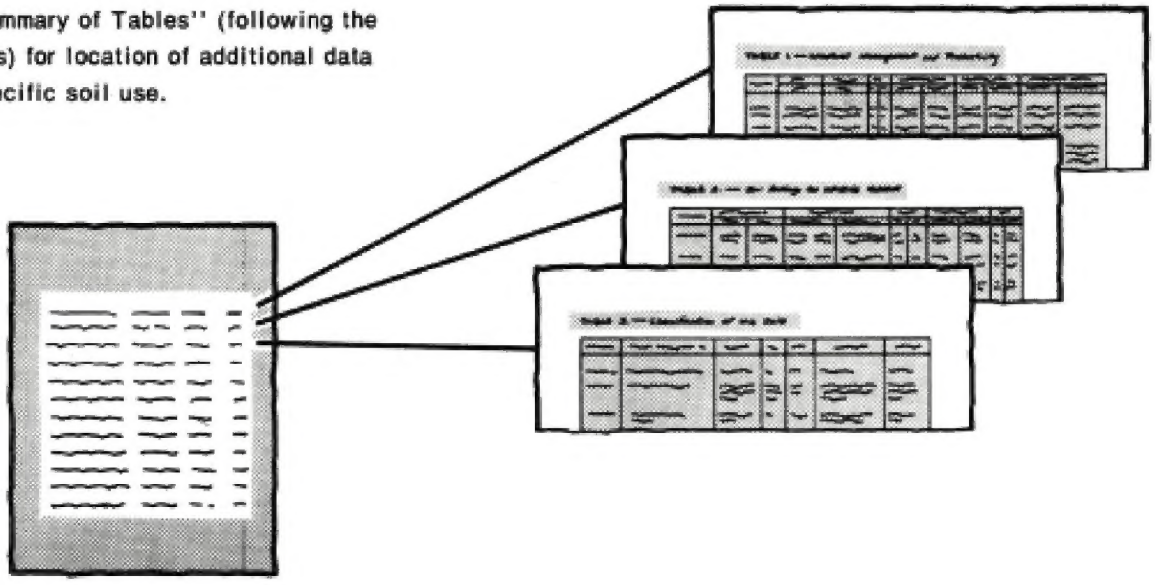
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1964-69. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1969. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Indian Affairs, and the Utah Agricultural Experiment Station.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Hogan Rock in the western part of San Juan County.

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Foreword

The Soil Survey of the Navajo Indian Reservation, San Juan County, Utah, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

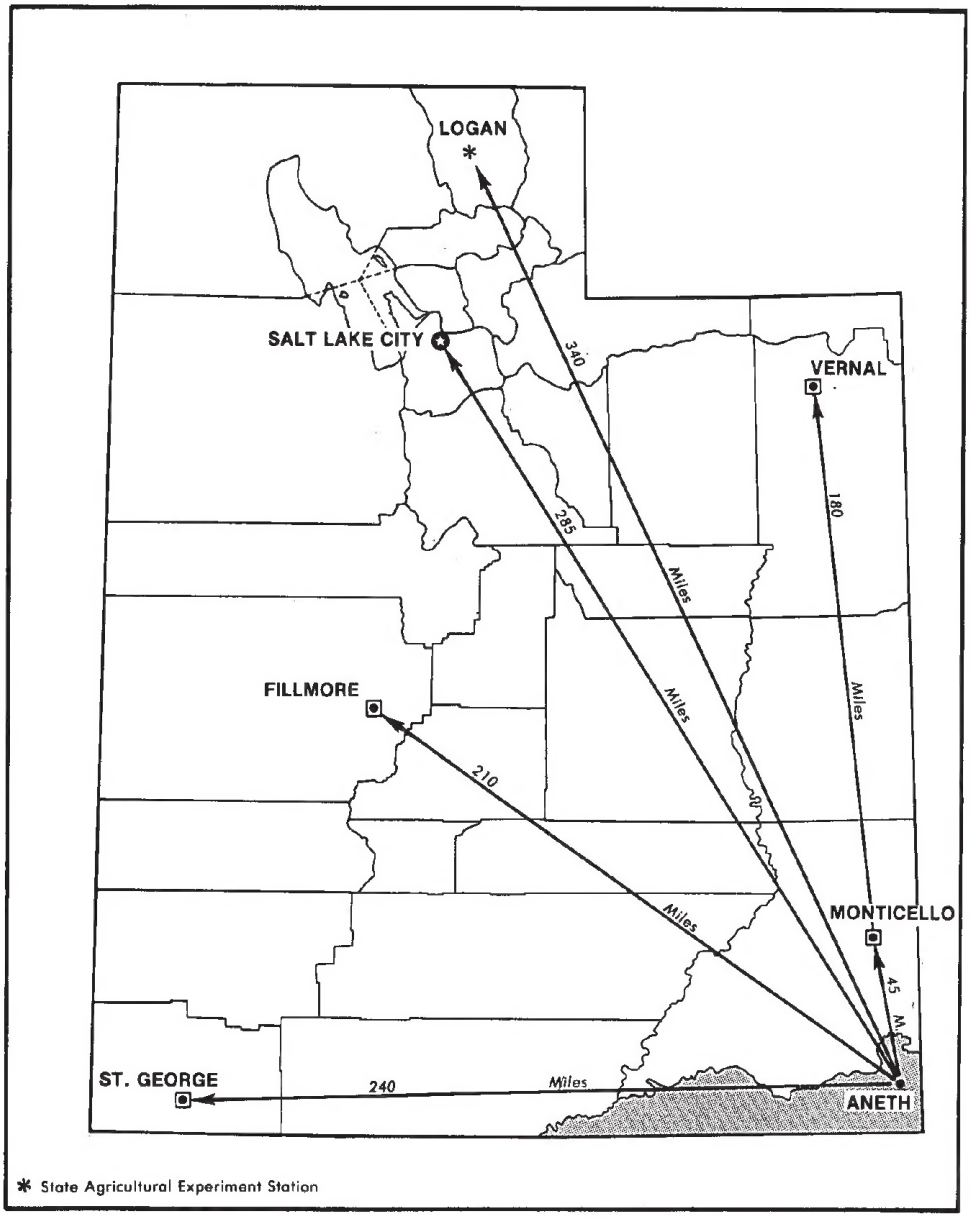
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

George McMillan
State Conservationist
Soil Conservation Service



Location of Navajo Indian Reservation, San Juan County, Utah.

SOIL SURVEY OF NAVAJO INDIAN RESERVATION, SAN JUAN COUNTY, UTAH

By Woodrow Nielson and Austin J. Erickson, Soil Conservation Service

Soils surveyed by Willard Kutac, Raymond W. Van Camp, and Fern Vest,
Bureau of Indian Affairs

United States Department of Agriculture, Soil Conservation Service, and
United States Department of the Interior, Bureau of Indian Affairs,
in cooperation with the Utah Agricultural Experiment Station

The Soil Survey of the NAVAJO INDIAN RESERVATION, SAN JUAN COUNTY, UTAH, was made in the part of San Juan County that is within the Navajo Indian Reservation. The area surveyed, the southeasternmost part of the county, borders Arizona on the south and Colorado on the east. Through most of the area, the northern boundary is the San Juan River. In the eastern part, it is about 10 to 15 miles north of the river. The western boundary is Lake Powell on the Colorado River. The San Juan and Colorado Rivers have cut a deep gorge along the northern and western boundaries.

San Juan County is in the southeastern part of Utah (see facing page). Blanding, the county seat, has a population of about 2,500.

The area surveyed, largely the Colorado and Green River Plateaus, is approximately one-fourth of San Juan County. The total area is 1,336,185 acres, or about 2,087 square miles.

The communities of Aneth and Montezuma Creek are on the banks of the San Juan River in the eastern part of the survey area. Each consists mainly of a trading post and a school.

Oil and gas production in the Aneth Basin oilfield is a major industry. A related industrial complex has been established near Aneth.

General nature of the area

The Navajo Indian Reservation, consisting of parts of New Mexico, Arizona, and Utah, is the largest reservation in the United States (*9*). It is about equal in size to the State of Virginia. The population is small. There are Navajo families throughout the accessible parts, in small scattered groups of no more than five hogans. Basic supplies can be obtained in five settlements or communities.

The first settlement or trading post in the area was established at Oljeto by John Wetherill in 1906. A trading post still operates at this location. A chapter house at Oljeto, completed by the Navajo Tribe in the early sixties, serves as a community meeting place.

In 1921, Harry Goulding acquired 640 acres of the Public Domain Land in Utah near the Arizona State line and constructed the Goulding Trading Post. The post, which provides guided tours of the highly scenic Monument Valley Area, has a cafe, a lodge, and a small general merchandise store. Mr. Goulding also granted property to the Seventh Day Adventist Church for a mission hospital near the trading post. The church manages a 15-bed hospital and a clinic.

A third small community, in addition to the communities of Aneth and Montezuma Creek, is on the lower eastern slope of the 10,388-foot Navajo Mountain. It has a trading post, a day school maintained by the Bureau of Indian Affairs, and a clinic under the direction of the Utah Indian Commission. The community, within one of the most remote regions of the Navajo Reservation, adjoins a large area of deep, straight-walled canyons and bare convoluted sandstone.

Monument Valley, spanning the Utah-Arizona State line, derives its name from the many straight-walled mesas, buttes, and rock pillars that rise perpendicularly from an otherwise gently rolling broad plain. This highly scenic area annually attracts thousands of visitors. Also in the valley, adjacent to Lake Powell and backwater of the San Juan River, are huge almost inaccessible areas of bare convoluted sandstone and deep, straight-walled canyons.

The survey area drains into Lake Powell or the San Juan River via innumerable canyons and washes. Navajo Mountain, at 10,388 feet, is the most prominent feature. Surrounding Navajo Mountain is a plain of warped dissected sandstone.

Originally from a region in north-central Canada, the Navajo entered the Southwest about the middle of the 15th century. They entered the survey area late in the 16th or early in the 17th century. The early economy was based on squash, beans, and maize and animals killed with bows and arrows. The acquisition of sheep, and later, horses from the Spaniards spurred the search for additional grazing lands.

The survey area became an official part of the Navajo Reservation in March 1933.

The economy

Except for oil and gas production in the Aneth Basin oilfield and the related industrial complex near Aneth, the survey area supports little industry. Income is derived largely from the sale of wool, sheep, and goats, and to a small extent from cattle, which are gradually replacing sheep. This income supplements wages earned from jobs outside the survey area.

New industry is developing in the area. The Black Mesa coal mining and the electrical generating plant at Page will provide several hundred job opportunities.

The climate

E. ARLO RICHARDSON, climatologist, Utah State Department of Agriculture, helped prepare this section.

The Navajo Indian Reservation survey area, along the southern border of the State of Utah, forms a significant part of the drainage to the lower San Juan River. Except for Navajo Mountain, most of the region is a series of high plateaus, nearly a mile above sea level, which are cut by washes and canyons that drain into the San Juan River.

The Sierra Nevada Mountains and the Rockies have a marked influence on the climate of these areas. The Rockies form a barrier against the cold outbreaks from the Great Plains, and the Sierras against much of the moisture from the Pacific. As a result, the climate in general is that of a cool desert. Precipitation is light, humidity is generally low, and there is a large diurnal range in temperature.

Much of the moisture received in the area originates in the Gulf of Mexico. As the Bermuda high pressure cell moves westward, moisture from the Gulf is pumped northwestward into the eastern part of Utah, resulting in considerable thunderstorm activity. In general, however, the wettest period of the year is late in September and in October when lows aloft develop over Nevada and sweep across the southern part of Utah. Moisture in winter is associated with the tail ends of Pacific storm fronts that move across the area.

The average annual rainfall is less than 10 inches a year in all areas except the upper elevations of Navajo Mountain. Tables 1, 2, and 3 show temperature and precipitation data for the area. As is characteristic of such a desert type regime, precipitation varies widely. In 1 year out of 10, monthly rainfall in excess of 1.82 inches can be expected during October at the Mexican Hat weather station, and 5.47 inches at the Aneth weather station. Daily extremes, as reported at the four weather stations in the area, range from 1.26 inches in 24 hours at Mexican Hat to 1.80 inches at Navajo Mountain. Such large amounts of moisture falling on dry desert soils produce rapid runoff, and considerable danger from flash flooding can be expected. In contrast, a period without measurable accumulations of moisture has been reported in nearly every month of the year.

Snowfall is generally light with less than 12 inches a year in most sections of the survey area. Occasional heavy snowstorms accompanied by strong winds and drifting snow have caused considerable inconvenience to ranchers.

Winters are cold. A minimum of 0 degrees or lower can be expected in more than 30 percent of the years. Maximum temperatures in excess of 100 degrees occur during most summer months. The low humidity in summer, however, makes the high temperature more bearable.

As a result of the low humidity and the general windspeed, the evaporation rate is very high. The estimated average monthly evaporation at the Mexican Hat weather station is about 78 inches during the period April through October. The evaporation rate is lowest in October and highest in July.

The average length of the growing season ranges from a little less than 140 days to more than 200 days.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during

the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Rock outcrop-Lithic Torriorthents-Badland

Shallow and very shallow, well drained soils that formed on uplands and mesas in residuum, colluvium, and alluvium derived from mixed sedimentary rock; also Rock outcrop and Badland

This map unit is made up of rolling to very steep soils, Rock outcrop, and Badland on uplands, mesa side slopes, canyon walls, and dissected mountain slopes. It occurs as many widely scattered areas throughout the survey area. It makes up about 39 percent of the survey area.

The soils in this unit are shallow and very shallow and well drained. They formed in mixed residuum, colluvium, and alluvium derived from sedimentary rock. The miscellaneous areas are exposed sandstone, shale, and limestone bedrock.

The dominant natural vegetation is desert grasses and shrubs. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 8 inches. The average frost-free season is about 150 days. Elevations range from 4,200 to 6,500 feet.

Rock outcrop makes up about 35 percent of the unit, Lithic Torriorthents about 20 percent, Badland about 15 percent, and minor soils the remaining 30 percent.

Scattered Rock outcrop occurs throughout the unit. Badland occurs as several scattered areas in the eastern half of the unit. It is generally associated with the Morrison Formation. Lithic Torriorthents are intermingled with Rock outcrop.

This map unit is scenic. It is used for water supply, wildlife habitat, and limited grazing. The shallow soils or exposed bedrock and the steep slopes are serious restrictions to almost any kind of development.

2. Tohona-Raplee

Moderately deep, well drained soils that formed on uplands, mesas, and pediments in residuum and alluvium derived from gypsiferous sedimentary rock

This map unit is on gently undulating to rolling uplands, benches, and dissected pediments. It occurs as a long narrow area between Comb Ridge and Gypsum Creek and as several scattered areas north of the San Juan River in the northeastern part of the survey area. It makes up about 2 percent of the survey area.

The soils in this unit formed in residuum and alluvium derived from sedimentary rock that is high in gypsum.

The natural vegetation is desert grasses, forbs, and shrubs that are relatively salt tolerant. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 7 inches. The average frost-free season is about 160 days. Elevations range from 4,600 to 5,000 feet.

Tohona soils make up about 50 percent of the unit, Raplee soils about 40 percent, and minor soils and Rock outcrop the remaining 10 percent.

Tohona soils are moderately deep and well drained. They are typically sandy clay loam throughout. The lower part of the subsoil is about 10 percent gypsum. It is underlain by weathered mudstone at a depth of about 34 inches. Tohona soils are moderately to very strongly alkaline.

Raplee soils are moderately deep and well drained. They are typically very fine sandy loam that is 20 to 50 percent gypsum. They are underlain by weathered sandstone and shale at a depth of about 22 inches.

The main minor soils of this unit are Lithic Torriorthents, Typic Torrifluvents, and Rock outcrop.

This unit is used for grazing and wildlife habitat. The Tohona and Raplee soils have inherent low ability to support a load and are subject to settlement because of the high gypsum content. They also have moderate to severe restrictions for other uses because of the depth to rock. Dwellings and road designs can be modified to partially offset some of these limiting soil features.

3. Moenkopie-Hoskinnini-Rock outcrop

Shallow and very shallow, well drained soils that formed on upland pediments and in broad valleys in residuum and alluvium derived from sedimentary rock; also Rock outcrop

This map unit is on gently undulating to hilly uplands and dissected pediments and in broad valleys. It occurs as numerous, scattered areas from the east-central part to the extreme western part of the survey area. It makes up about 8 percent of the survey area.

The soils in this unit formed in residuum and alluvium derived from sedimentary rocks.

The natural vegetation is desert grasses, forbs, and shrubs. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 7 inches. The average frost-free season is about 160 days. Elevations range from 3,900 to 5,500 feet.

Moenkopie soils make up about 40 percent of the unit, Hoskinnini soils about 25 percent, Rock outcrop about 20 percent, and minor soils and Badland the remaining 15 percent.

Moenkopie soils are shallow to very shallow and well drained. The surface layer is typically sandy loam, and the underlying layer is silt loam. Weathered sandstone and shale bedrock is at a depth of about 15 inches. A thin surface pavement of angular gravel is in many places.

Hoskinnini soils are shallow to very shallow and well drained. Typically the surface layer is sandy loam, and the underlying layer is fine sandy loam. Hard sandstone bedrock is at a depth of about 11 inches.

Rock outcrop consists of exposed sandstone and shale bedrock. It is intermingled with the Moenkopie and Hoskinnini soils.

Minor in this unit are Badland, Mota soils, and some moderately deep sandy soils.

This unit is used for grazing and wildlife habitat. The shallow depth of the soil is a severe limitation to most kinds of development.

4. Piute-Pickrell-Rock outcrop

Shallow and very shallow, well drained soils that formed on uplands, benches, and mesas in eolian deposits and residuum derived from sandstone; also Rock outcrop

This map unit is on undulating to rolling uplands, benches, and mesas. It occurs as several small, scattered areas in the central and western parts of the survey area. It makes up about 4 percent of the survey area.

The soils in this unit formed in eolian deposits and residuum derived mainly from sandstone.

The natural vegetation is desert grasses and shrubs that survive on shallow, sandy soils. The mean annual air temperature is about 54 degrees F, and the average annual precipitation is about 8 inches. The average frost-free season is about 150 days. Elevations range from 4,600 to 5,800 feet.

Piute soils make up about 35 percent of the unit, Pickrell soils about 25 percent, Rock outcrop about 20 percent, and minor soils and Badland the remaining 20 percent.

Piute soils are very shallow and well drained. Typically the surface layer is loamy fine sand. Sandstone bedrock is at a depth of about 9 inches.

Pickrell soils are shallow and well drained. Typically the surface layer and subsoil are loamy fine sand. The substratum is gravelly loamy fine sand that is about 30 percent lime nodules. Sandstone bedrock is at a depth of about 18 inches.

Rock outcrop consists of exposed sandstone and shale bedrock. It is intermingled with the Piute and Pickrell soils.

Minor in this unit are Badland and Moepitz, Sheppard, and Mespun soils.

This map unit is used for grazing and wildlife habitat. The shallow depth of the soil is a severe limitation to most kinds of development.

5. Nakai-Deleco-Monue

Shallow to deep, well drained soils that formed on terraces, benches, and mesas in alluvium and eolian deposits derived from sedimentary rock

This map unit is on undulating to very steep terraces, benches, fans, and mesa tops. It occurs as many small, scattered areas in the western two-thirds of the survey area and near the San Juan River in the eastern part. It makes up about 8 percent of the survey area.

The soils in this unit formed in eolian deposits and alluvium derived from sedimentary rock.

The natural vegetation is desert grasses, forbs, and shrubs. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 8 inches. The average frost-free season is about 155 days. Elevations range from 4,500 to 6,400 feet.

Nakai and Deleco soils each make up about 35 percent of the unit, Monue soils about 15 percent, and minor soils and Rock outcrop the remaining 15 percent.

Nakai soils dominantly occupy broad undulating valleys, uplands, and mesa tops. The Deleco soils are mainly on gently rolling to very steep terraces, benches, and mesa tops. Monue soils are on broad, rolling ridges and benches.

Nakai soils are very deep and well drained. Typically the surface layer is loamy fine sand and very fine sandy loam, and the underlying layer is fine sandy loam, very fine sandy loam, and loamy fine sand that contains a zone of carbonate accumulation.

Deleco soils are shallow to very shallow over a lime-cemented hardpan and are well drained. Typically the sur-

face layer is loamy fine sand, and the underlying layer is gravelly and very gravelly sandy loam. A strongly cemented lime hardpan is at a depth of about 7 inches.

Monue soils are deep and well drained. Typically the surface layer is loamy fine sand, and the underlying layer is very fine sandy loam or fine sandy loam. Weathered sandstone or shale is at a depth of about 46 inches.

Minor in this unit are Rock outcrop and Sheppard, Mota, and Sogzie soils.

This unit is used for grazing and wildlife habitat. The lime hardpan of the Deleco soils is a severe limitation for dwellings and a moderate limitation for roads and streets. Nakai and Monue soils have inherent limited ability to support a load. Dwellings and road designs can be modified to offset this limiting feature.

6. Mota-Neskahi-Oljeto

Very deep, well drained and somewhat excessively drained soils that formed in valleys and on mesas, upland benches, and fans in eolian deposits and alluvium derived from sandstone

This map unit occupies nearly level to undulating valleys, uplands, benches, and fans. It occurs as numerous scattered areas in the eastern and west-central parts of the survey area. It makes up about 5 percent of the survey area.

The soils in this unit formed in eolian deposits and alluvium derived mainly from sandstone.

The natural vegetation is desert grasses, forbs, and shrubs. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 7 inches. The average frost-free season is about 160 days. Elevations range from 4,800 to 5,400 feet.

Mota soils make up about 50 percent of the unit, Neskahi soils about 20 percent, Oljeto soils about 10 percent, and minor soils and Rock outcrop the remaining 20 percent.

Mota soils are mainly nearly level to undulating and are on uplands and benches. Neskahi soils are generally nearly level to undulating and are on broad valley bottoms and fans. Oljeto soils are mainly undulating and are on fans.

Mota soils are very deep and well drained. Typically the surface layer is loamy fine sand, and the underlying layer is very fine sandy loam and loamy very fine sand to a depth of 60 inches or more. A zone of carbonate accumulation is at a depth of about 6 inches.

Neskahi soils are very deep and well drained. Typically the surface layer is loamy fine sand, and the underlying layer is very fine sandy loam and fine sandy loam to a depth of 60 inches or more.

Oljeto soils are very deep and somewhat excessively drained. Typically the surface layer is loamy fine sand, and the underlying layer is gravelly sand and very gravelly loamy sand to a depth of 60 inches or more. A zone of carbonate accumulation is at a depth of about 20 inches.

Minor in this unit are Nepalto, Sheppard, Nakai, Deleco, and Monue soils and Rock outcrop.

This unit is used for grazing and wildlife habitat. The Mota and Neskahi soils have moderate limitations for some kinds of development because of their inherent low ability to support a load. Building and road designs can be modified to offset this limiting feature. Oljeto soils have few limitations for most kinds of development.

7. Aneth-Sheppard

Very deep and deep, somewhat excessively drained soils that formed on uplands and valley bottoms in eolian deposits and alluvium derived from sandstone

This map unit is on valley bottoms and undulating to rolling uplands. It occurs as numerous scattered areas in the central and eastern parts of the survey area. It makes up about 15 percent of the survey area.

The soils in this unit formed in eolian deposits and alluvium derived mainly from sandstone.

The natural vegetation is desert and semidesert grasses, forbs, and shrubs that thrive in sandy soil. The mean annual air temperature is about 53 degrees F, and the average annual precipitation is about 8 inches. The average frost-free season is about 150 days. Elevations range from 4,400 to 6,000 feet.

Aneth soils make up about 45 percent of the unit, Sheppard soils about 35 percent, and minor soils and Rock outcrop the remaining 20 percent.

Aneth soils generally are on valley bottoms, and Sheppard soils on undulating to rolling uplands.

Aneth soils are very deep and well drained to somewhat excessively drained. Typically the surface layer is loamy fine sand or sandy clay loam. The underlying layer is loamy fine sand and fine sandy loam to a depth of 60 inches or more.

Sheppard soils are deep or very deep and somewhat excessively drained. Typically the surface layer is fine sand, and the underlying layer is loamy fine sand to a depth of 60 inches or more. Dunes and hummocks are very common.

Minor in this unit are Rock outcrop and Sogzie, Trail, and Mota soils.

This unit is used for grazing and wildlife habitat. Most of the soils have no severe limitations for most kinds of development, but occasional flooding on some Aneth soils is a severe limitation unless it is controlled.

8. Monue-Moepitz-Sheppard

Moderately deep and deep, well drained and somewhat excessively drained soils that formed on uplands and valley bottoms in eolian deposits and alluvium derived from sandstone

This map unit is on valley bottoms and undulating to rolling uplands. It occurs as numerous areas in the western and west-central parts of the survey area. It makes up about 4 percent of the survey area.

The soils in this unit formed in eolian deposits and alluvium derived mainly from sandstone.

The natural vegetation is desert grasses, forbs, and shrubs. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 7 inches. The average frost-free season is about 160 days. Elevations range from 4,500 to 5,400 feet.

Monue soils make up about 35 percent of the unit, Moepitz soils 25 percent, Sheppard soils 25 percent, and minor soils and Rock outcrop the remaining 15 percent.

Monue soils are on broad valley bottoms and undulating uplands. The Moepitz and Sheppard soils occur on undulating to rolling uplands.

Monue soils are deep and well drained. Typically, the surface layer is loamy fine sand, and the underlying layer is very fine sandy loam or fine sandy loam. Weathered shale and sandstone are at a depth of about 46 inches.

Moepitz soils are moderately deep and well drained. Typically the surface layer is very fine sand, and the underlying layer is loamy very fine sand or very fine sandy loam. Sandstone bedrock is at a depth of about 30 inches.

Sheppard soils are deep and somewhat excessively drained. Typically the surface layer is fine sand, and the underlying layer is loamy fine sand. Sandstone is at a depth of about 60 inches.

Minor in this unit are Rock outcrop and Deleco and Nakai soils.

This unit is used for grazing and wildlife habitat. Monue soils have inherent limited ability to support a load. Moepitz soils have limitations for some kinds of development because of the depth to bedrock. Dwellings and road designs can be modified to partially offset these limiting features. Sheppard soils have few severe limitations for most kinds of development.

9. Shedado-Begay-Anasazi

Moderately deep and very deep, well drained soils that formed on mesas, uplands, and pediments in eolian deposits and residuum derived from sandstone

This map unit is on broad mesa tops, undulating uplands, and undulating to steep dissected pediments. It occurs as several areas in the western part of the survey area. It makes up about 3 percent of the survey area.

The soils in this unit formed in eolian deposits and residuum derived from sandstone.

The natural vegetation is semidesert grasses, forbs, shrubs, and trees (pinyon pine and Utah juniper). The mean annual air temperature is about 48 degrees F, and the average annual precipitation is about 11 inches. The average frost-free season is about 125 days. Elevations range from 5,000 to 6,800 feet.

Shedado and Begay soils each make up about 25 percent of the unit, Anasazi soils about 20 percent, and minor soils and Rock outcrop the remaining 30 percent.

Shedado and Begay soils are on broad mesa tops and undulating uplands. Anasazi soils are on undulating to steep dissected pediments.

Shedado soils are moderately deep and well drained. Typically the surface layer is loamy very fine sand, and the underlying layer is very fine sand and loamy very fine sand. Sandstone bedrock is at a depth of about 35 inches.

Begay soils are very deep and well drained. Typically the surface layer is loamy fine sand, and the underlying layer is very fine sandy loam to a depth of 60 inches or more.

Anasazi soils are moderately deep and well drained. Typically the surface layer is very stony very fine sandy loam and the underlying layer is very fine sandy loam and fine sandy loam. Sandstone bedrock is at a depth of about 24 inches.

Minor in this unit are Rock outcrop and Redbank, Mespun, and Piute soils.

This unit is used for grazing and wildlife habitat. Begay soils have inherent limited ability to support a load.

Shedado and Anasazi soils have limitations for some kinds of development because of the depth to bedrock. Dwellings and road designs can be modified to partially offset these limiting features.

10. Namon-Rock outcrop-Ustollic Haplargids

Moderately deep and deep, well drained soils that formed on plateaus and mountain slopes in residuum and colluvium derived from sandstone and shale; also Rock outcrop

This map unit is on rolling to very steep plateaus and mountain slopes. It is on Navajo Mountain in the western part of the survey area. It makes up about 3 percent of the survey area.

The soils in this unit formed in residuum and colluvium derived from sedimentary rock. The Rock outcrop consists of exposed sandstone and shale.

The dominant natural vegetation is upland and mountain grasses, forbs, shrubs, and trees. The mean annual air temperature is about 42 degrees F, and the average annual rainfall is about 17 inches. The average frost-free season is about 90 days. Elevations range from 6,000 to 10,300 feet.

Namon soils make up about 20 percent of the unit, Rock outcrop about 20 percent, Ustollic Haplargids and Ustic Torriorthents each about 20 percent, and shallow and very shallow minor soils the remaining 20 percent.

Namon soils are deep and well drained. Typically the surface layer and subsoil are very cobbly very fine sandy loam. Sandstone is at a depth of about 48 inches.

Ustollic Haplargids and Ustic Torriorthents are moderately deep and deep and well drained. They range from gravelly loam to very cobbly very fine sandy loam. Bedrock is at a depth of 20 to 60 inches.

Namon soils are used for grazing, wildlife habitat, and water supply. The rest of this unit is used for wildlife habitat and water supply. Steep slopes and Rock outcrop are severe limitations to most kinds of development.

11. Aquic Ustifluvents-Typic Fluvaquents

Very deep, somewhat poorly drained to very poorly drained soils that formed on valley bottoms in alluvium derived from sedimentary rock

This map unit is made up of nearly level soils on valley bottoms. It occurs along the San Juan River Valley in the eastern half of the survey area. It makes up about 2 percent of the survey area.

The soils in this unit formed in alluvium derived from sedimentary rock. The dominant natural vegetation is water-loving grasses, forbs, shrubs, and trees. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 7 inches. The average frost-free season is about 165 days. Elevations range from 4,400 to 4,600 feet.

Aquic Ustifluvents and Typic Fluvaquents each make up about 30 percent of the unit and minor soils about 40 percent. Aquic Ustifluvents and Typic Fluvaquents are on river bottoms and recent flood plains.

Aquic Ustifluvents are very deep and very poorly drained. They vary from clay loam to very gravelly sandy loam and are stratified.

Typic Fluvaquents are very deep and poorly drained to somewhat poorly drained. They vary from clay loam to very gravelly sandy loam and are stratified.

The main minor soils of this unit are Tezuma soils and Playas.

This unit is used mainly for grazing and wildlife habitat. The hazards of restricted drainage and flooding are severe limitations to almost any kind of development except wetland wildlife habitat.

12. Whit-Sogzie

Very deep, well drained soils that formed on mesas and terraces in eolian deposits derived from sandstone

This map unit is on undulating mesa tops and broad terraces. It occurs as numerous areas in the eastern and northeastern parts of the survey area. It makes up about 6 percent of the survey area.

The soils in this unit formed in eolian deposits. They have a zone of carbonate accumulation.

The natural vegetation is desert and semidesert grasses, forbs, and shrubs. The mean annual air temperature is about 53 degrees F, and the average annual precipitation is about 8 inches. The average frost-free season is about 145 days. Elevations range from 4,600 to 6,000 feet.

Whit soils make up about 50 percent of the unit, Sogzie soils about 25 percent, and Rock outcrop and minor soils the remaining 25 percent.

Whit and Sogzie soils are very deep and well drained. Typically the surface layer is very fine sandy loam. The underlying layer is very fine sandy loam to a depth of 60 inches or more. A zone of carbonate accumulation is below the subsoil.

The main minor soils of this unit are Rock outcrop and Sheppard and Tohona variant soils.

This unit is used for grazing and wildlife habitat. Whit and Sogzie soils have inherent low ability to support a load. Dwellings and road designs can be modified to offset this limiting soil feature.

13. Gotho-Tezuma

Very deep, well drained soils that formed in narrow alluvial valleys in alluvium derived from sedimentary rock

This map unit is made up of nearly level to gently undulating soils on alluvial plains. It occurs mainly along Gothic Creek and Montezuma Creek and their major tributaries, and along two other drainageways south of McCracken Mesa. It makes up about 1 percent of the survey area.

The soils in this unit formed in mixed alluvium derived from sedimentary rock.

The dominant natural vegetation is salt- and alkali-tolerant grasses and shrubs. The mean annual air temperature is about 55 degrees F, and the average annual precipitation is about 7 inches. The average frost-free season is about 155 days. Elevations range from 4,600 to 5,200 feet.

Gotho soils make up about 40 percent of the unit, Tezuma soils about 20 percent, and minor soils the remaining 40 percent.

Gotho and Tezuma soils are along narrow valley bottoms of intermittent streams.

Gotho soils are very deep and well drained. Typically the surface layer is clay, sandy clay loam, or fine sandy loam. The underlying layer is stratified and ranges from clay to fine sandy loam but is mainly sandy clay loam or fine sandy loam. These soils are strongly to very strongly alkaline.

Tezuma soils are very deep and well drained. Typically the surface layer is silt loam. The underlying layer is stratified and ranges from silt loam to silty clay but is mainly silty clay. These soils are very strongly alkaline.

The main minor soils of this unit are Sheppard and Tohona soils, Riverwash, and Rock outcrop.

This unit is used for grazing and wildlife habitat. The slow permeability of these soils can be a problem for septic tank absorption fields. Tezuma and Gotho soils have inherent low ability to support a load and have moderate to high shrink-swell potential. Dwellings and road designs can be modified to offset these limiting soil features.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for

each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Aneth series, for example, was named for the town of Aneth in San Juan County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Aneth sandy clay loam, strongly alkali, 0 to 3 percent slopes, is one of several phases within the Aneth series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Monue-Sheppard complex, 1 to 12 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Sogzie-Sheppard association, sloping, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Gotho soils, 0 to 3 percent slopes, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

AaC—Anasazi very stony very fine sandy loam, 3 to 10 percent slopes. This soil is moderately deep and well drained. It is on dissected pediments at elevations of 5,800 to 6,400 feet in an area east and northeast of the base of Navajo Mountain (fig. 1). It formed in eolian deposits and residuum derived from sandstone.

The average annual precipitation is about 12 inches. Mean annual air temperature is about 48 degrees F, and the average frost-free season is about 125 days. Slopes are long.

Included with this soil in mapping are small areas of a very shallow sandy soil, a shallow loamy soil, and Rock outcrop.

In a typical profile the surface layer is yellowish red very stony very fine sandy loam about 4 inches thick. The subsoil is red very fine sandy loam about 6 inches thick. The substratum is pink fine sandy loam. It is underlain by sandstone bedrock at a depth of 24 inches.

This soil is mainly mildly to moderately alkaline but is strongly alkaline in the lower part in some pedons. About 15 percent of the surface is covered by stones and cobbles. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderately rapid. The effective rooting depth is 20 to 40 inches, and the available water capacity is low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The dominant potential native vegetation is Indian ricegrass, blue grama, galleta, needleandthread, big sagebrush, Mormon-tea, pinyon pine, and Utah juniper. The potential annual yield of air-dry herbage is about 800 pounds per acre in favorable years and 350 pounds in unfavorable years.

Suggested range management practices are fencing and rotation grazing. Capability subclass VIIs; Calcareous range site, precipitation zone 3.

AaF—Anasazi very stony very fine sandy loam, 10 to 25 percent slopes. This soil is moderately deep and well drained. It is on dissected pediments at elevations of 6,000 to 6,400 feet in an area east and northeast of the base of Navajo Mountain. It formed in eolian deposits and residuum derived from sandstone.

The average annual precipitation is about 12 inches. Mean annual air temperature is about 48 degrees F, and the average frost-free season is about 125 days. Slopes are long.

Included with this soil in mapping are small areas of a very shallow sandy soil, a shallow loamy soil, and Rock outcrop.

In a typical profile the surface layer is yellowish red very stony very fine sandy loam about 4 inches thick. The subsoil is red very fine sandy loam about 6 inches thick. The substratum is pink fine sandy loam. It is underlain by sandstone bedrock at a depth of about 24 inches.

This soil is mainly mildly or moderately alkaline but is strongly alkaline in the lower part of some profiles. About 15 percent of the surface layer is covered by stones and cobbles. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderately rapid. The effective rooting depth is 20 to 40 inches, and the available water capacity is low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The dominant potential native vegetation is Indian ricegrass, blue grama, galleta, needleandthread, big sagebrush, Mormon-tea, pinyon pine, and Utah juniper. The potential annual yield of air-dry herbage is about 800 pounds per acre in favorable years and 350 pounds in unfavorable years.

Suggested range management practices are fencing and rotation grazing. Capability subclass VIIs; Calcareous range site, precipitation zone 3.

AmB—Aneth loamy fine sand, 1 to 8 percent slopes. This soil is very deep and somewhat excessively drained. It is on valley bottoms and terraces in scattered areas throughout the eastern part of the survey area (fig. 2). Elevation is 4,700 to 5,500 feet. The soil formed in eolian material derived mainly from sandstone.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 165 days. Slopes are long.

Included with this soil in mapping are small areas of Sheppard fine sand, hummocky, and Nakai loamy fine sand, 1 to 8 percent slopes.

In a typical profile the surface layer is yellowish red loamy fine sand about 7 inches thick. Below this is about 19 inches of yellowish red loamy fine sand and about 10 inches of reddish yellow fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is moderately or strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The dominant potential native vegetation is black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

Suggested range management practices are fencing and rotation grazing. Capability subclass VIIs; Sandy range site, precipitation zone 1.

AnA—Aneth loamy fine sand, moderately alkali, 0 to 3 percent slopes. This soil is very deep, well drained, and moderately alkali affected. It is on alluvial flood plains and valley bottoms at elevations of 4,700 to 5,500 feet. It is in an area adjacent to Gothic Creek near its confluence with the San Juan River and in an area adjacent to Comb Ridge where Chinle Wash bisects the ridge. This soil formed in eolian materials derived from sandstone.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 165 days. Slopes are long.

Included with this soil in mapping are small areas of Sheppard fine sand, rolling; Gotho sandy clay loam, 0 to 3 percent slopes; Gotho fine sandy loam, 1 to 8 percent slopes; and Aneth sandy clay loam, 0 to 3 percent slopes.

In a typical profile the surface layer is yellowish red loamy fine sand about 7 inches thick. Below this is about 19 inches of yellowish red loamy fine sand and about 10 inches of reddish yellow fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is moderately or strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is slight.

This soil is used as range and wildlife habitat. The dominant potential native vegetation is Indian ricegrass, alkali sacaton, western wheatgrass, Mormon-tea, and shadscale. The potential annual yield of air-dry herbage is about 950 pounds per acre in favorable years and 425 pounds in unfavorable years.

Suggested range management practices are fencing and rotation grazing. At present, revegetation is not practical. Water spreading may be beneficial. Capability subclass VIIs; Saline Lowlands range site, precipitation zone 1.

AsA—Aneth sandy clay loam, 0 to 3 percent slopes. This soil is very deep and somewhat excessively drained. It is in several scattered areas on narrow valley bottoms near stream channels in the southeastern part of the sur-

vey area. Elevation is 4,700 to 5,500 feet. This soil formed in eolian material and alluvium derived mainly from sandstone.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 165 days. Slopes are long.

Included with this soil in mapping are small areas of Aneth loamy fine sand, 1 to 8 percent slopes.

In a typical profile the surface layer is yellowish red sandy clay loam about 7 inches thick. Below this is about 19 inches of red loamy fine sand and about 10 inches of reddish yellow fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is moderately to strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is slight.

This soil is used as range and wildlife habitat. The dominant potential native vegetation is western wheatgrass, galleta, Indian ricegrass, black grama, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 1,000 pounds per acre in favorable years and 500 pounds in unfavorable years.

Suggested range management practices are fencing and rotation grazing. Water spreading may be beneficial. Capability subclass VIIs; Overflow range site, precipitation zone 1.

AtA—Aneth sandy clay loam, strongly alkali, 0 to 3 percent slopes. This soil is very deep, well drained, and strongly alkali affected. It is on narrow valley bottoms near stream channels at elevations of 4,900 to 5,200 feet. It is in an area near the Arizona border in the southeastern part of the survey area. It formed in eolian material and alluvium derived mainly from sandstone.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 165 days. Slopes are long.

Included with this soil in mapping are small areas of Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes.

In a typical profile the surface layer is yellowish red sandy clay loam about 7 inches thick. Below this is about 19 inches of yellowish red loamy fine sand and about 10 inches of reddish yellow fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is slight.

This soil is used as range and wildlife habitat. The dominant potential native vegetation is inland saltgrass, western wheatgrass, galleta, alkali sacaton, fourwing saltbush, and black greasewood. The potential annual yield of air-dry herbage is about 950 pounds per acre in favorable years and 425 pounds in unfavorable years.

Suggested range management practices are fencing and rotation grazing. At present, revegetation is not practical. Water spreading may be beneficial. Capability subclass VIIs; Saline Lowlands range site, precipitation zone 1.

AUC—Aneth-Sheppard association, rolling. This map unit occurs as scattered, large areas in the east central part of the survey area between White Mesa and Hogan Mesa. It is on rolling uplands and broad valleys at elevations of 4,700 to 5,200 feet. Aneth loamy fine sand, 1 to 8 percent slopes, makes up about 50 percent of the unit. It is mainly on short slopes in areas between the dunes and hummocks. Sheppard fine sand, rolling, makes up about 30 percent. It occurs mainly as dunes and hummocks 2 to 15 feet high. Slopes are long and range from 2 to 8 percent.

Included with this unit in mapping are small areas of Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes, and areas of Badland.

Both Aneth and Sheppard soils formed in eolian material derived from sandstone. The average annual precipitation is about 8 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 165 days.

The Aneth soil is very deep and somewhat excessively drained. In a typical profile the surface layer is yellowish red loamy fine sand about 7 inches thick. Below this is about 19 inches of yellowish red loamy fine sand and 10 inches of reddish yellow fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is moderately or strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is slight.

The Sheppard soil is very deep and somewhat excessively drained. In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. The underlying layer to a depth of 60 inches or more is reddish yellow loamy fine sand or fine sand. The soil is mildly or moderately alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is very high for wind and slight for water.

The Aneth and Sheppard soils are used as range and wildlife habitat. The potential native vegetation on the Aneth soil is black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

The potential native vegetation on the Sheppard soil is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage is about 575 pounds per acre in favorable years and 275 pounds in unfavorable years.

Suggested range management practices are fencing and rotation grazing or rest-rotation grazing. Extreme care is needed on the sand site to leave enough litter or ground cover to help control wind erosion. Both soils in capability subclass VIIs; Aneth soil in Sandy range site, precipitation zone 1, Sheppard soil in Choppy Sand range site, precipitation zone 1.

AV—Aquic Ustifluvents-Typic Fluvaquents association, gently sloping. This map unit occurs along the San Juan River in the eastern half of the survey area. It is on river bottoms and recent flood plains at elevations of 4,400 to 4,600 feet. Aquic Ustifluvents, about 40 percent of the unit, are in the lower, more frequently flooded areas. Typic Fluvaquents, about 40 percent of the unit, are in the higher, less frequently flooded areas. Both soils are characterized by short to medium, undulating slopes.

Included with this unit in mapping are small areas of Tezuma silt loam. Slope in these areas is 0 to 3 percent.

Both Aquic Ustifluvents and Typic Fluvaquents formed in mixed alluvium. The average annual precipitation is about 7 inches. The mean temperature is about 55 degrees F, and the average frost-free season is about 165 days.

Aquic Ustifluvents are very deep and very poorly drained or poorly drained. They are stratified. Texture varies from clay loam to very gravelly sandy loam. These soils are moderately or strongly alkaline and moderately or strongly saline.

Permeability is slow to rapid. The effective rooting depth for water-tolerant plants is 60 inches or more. The available water capacity is high. The organic matter content is low in the surface layer. Surface runoff is medium. The erosion hazard is moderate because of the position these soils occupy on the landscape.

Typic Fluvaquents are very deep and poorly drained or somewhat poorly drained. They are stratified. Texture varies from clay loam to very gravelly sandy loam. These soils are moderately or strongly alkaline and moderately or strongly saline.

Permeability is slow to rapid. The effective rooting depth is 60 inches or more for water-tolerant plants and 10 to 40 inches for plants having roots that will not tolerate standing water for long periods. The available water capacity is high. The organic matter content is low in the surface layer. Surface runoff is slow. The erosion hazard is high because of the position these soils occupy on the landscape.

This unit is used as range and wildlife habitat. The potential native vegetation on the Aquic Ustifluvents is green muhly, inland saltgrass, sedges, common cattail, American bulrush, saltcedar, willow and narrowleaf cottonwood. The potential annual yield of air-dry herbage is about 3,000 pounds per acre in favorable years and 2,500 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing for grazing control, and rotation grazing. In selected areas, chemical or mechanical brush control or plowing and reseeding with smooth bromegrass, orchardgrass, and ladino clover or alfalfa are beneficial. Both soils in capability subclass VIw; Subirrigated range site.

BA—Badland. This map unit is mainly nearly barren, severely eroded soft mudstone and sandstone. It is strongly sloping to very steep. Drainageways of intermittent streams form a network of branching gullies and rills. The vegetation is very sparse and is mainly annual weeds. Badland occurs as scattered areas in the eastern half of the survey area, from the vicinity of Chinle Wash eastward, mostly in the Morrison Formation.

Included with Badland in mapping are small areas of Sheppard soils and some shallow and very shallow soils.

Permeability is very slow. Surface runoff is very rapid, and the erosion hazard is very high.

Badland is scenic. It is used for water supply and wildlife habitat. It is not suitable for grazing. It should not be used as range. Capability subclass VIIIs.

BD—Badland-Typic Torrifluvents association, steep. This map unit occurs as large scattered areas in the eastern part of the survey area. It is on rolling to very steep sides of mesas and buttes, on valley slopes, and on broad rolling uplands. Elevations are 4,800 to 5,600 feet. Badland, about 40 percent of the unit, is barren or nearly barren and severely eroded. Slopes are rolling to very steep. Typic Torrifluvents, about 30 percent of the unit, are in the flatter, more protected areas and along alluvial bottoms. Other soils and Rock outcrop make up the remaining 30 percent.

Included with this unit in mapping are small areas of Sheppard soils and some shallow or very shallow soils.

Both Badland and Typic Torrifluvents are in areas where the average annual precipitation is about 8 inches. The mean temperature is about 54 degrees F, and the average frost-free season is about 150 days.

Badland has little or no soil mantle. The vegetation is sparse or absent. Permeability is very slow. Surface runoff is very rapid. The erosion hazard is very high.

Typic Torrifluvents are moderately deep or deep and well drained. They formed in mixed alluvium and eolian deposits. These soils range from loam to loamy sand. They are moderately or strongly alkaline.

Permeability is moderate to rapid. Surface runoff is slow to rapid. The erosion hazard is moderate or high.

Badland is scenic. It is used for water supply and wildlife habitat. It is not suitable for grazing.

Typic Torrifluvents are used as range and wildlife habitat. The potential native vegetation is galleta, Indian ricegrass, blue grama, shadscale, fourwing saltbush, and Mormon-tea. The potential annual yield of air-dry herbage is about 460 pounds per acre in favorable years and 230 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing, and deferred-rotation grazing. Mechanical practices are not desirable because of the erosion hazard. Badland in capability subclass VIIs; Typic Torrifluvents in capability subclass VIIe, Thin Breaks range site.

BbD—Begay loamy fine sand, 3 to 8 percent slopes. This soil is very deep and well drained. It is on undulating uplands and broad mesas in an area north of Navajo Mountain Trading Post and another area west of Navajo Mountain on Rainbow Plateau. Elevation is 5,500 to 6,000 feet. This soil formed in eolian deposits derived mainly from sandstone.

The average annual precipitation is about 10 inches. The mean annual air temperature is about 48 degrees F, and the average frost-free season is about 125 days. Slopes are long.

Included with this soil in mapping are small areas of Sheppard fine sand, high rainfall, hummocky, and Shedado loamy fine sand, 1 to 8 percent slopes.

In a typical profile the surface layer is yellowish red loamy fine sand about 3 inches thick. The subsoil is yellowish red very fine sandy loam about 13 inches thick. The substratum is yellowish red very fine sandy loam to a depth of 60 inches or more. The soil is mainly mildly or moderately alkaline but is strongly alkaline in the lower part of some profiles.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

This soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, shadscale, and big sagebrush. The potential annual yield of air-dry herbage is about 1,000 pounds per acre in favorable years and 500 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate a system of deferred-rotation grazing, reseeding with crested wheatgrass where needed, and chemical or mechanical treatment where needed to control undesirable vegetation. Capability subclass VIe; Sandy range site, precipitation zone 2.

DeE—Deleco loamy fine sand, 12 to 55 percent slopes. This well drained soil is shallow or very shallow over a lime-cemented hardpan. It is along the San Juan River south of Bluff on rolling to steep terraces and fans that are old river terrace remnants. Elevations are 4,400 to 5,000 feet. This soil formed in mixed alluvium and colluvium derived from sedimentary rock.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 55 degrees F, and the frost-free season is about 160 days. Slopes are short to medium.

Included with this soil in mapping are small areas of Sheppard fine sand, hummocky; Mota loamy fine sand, 1 to 8 percent slopes; and Rock outcrop.

In a typical profile the surface layer is yellowish red loamy fine sand about 3 inches thick. Below this are about 4 inches of light reddish brown gravelly sandy loam, about 3 inches of pinkish gray very gravelly sandy loam, and a pinkish white indurated lime hardpan about 4 inches thick. The next layer is about 28 inches of strongly cemented pinkish white sandy loam. The underlying material to a depth of 45 inches or more is light reddish brown sandy loam. The soil ranges from mildly to very strongly alkaline in individual layers. The depth to the hardpan ranges from 7 to 20 inches.

Permeability above the hardpan is moderately rapid. The effective rooting depth is 7 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is moderate or rapid. The erosion hazard is high.

This soil is used as range and wildlife habitat. The potential native vegetation is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, blackbrush, and black sagebrush. The potential annual yield of air-dry herbage is about 400 pounds per acre in favorable years and 200 pounds in unfavorable years.

Suggested range management practices are fencing to facilitate grazing control, winter utilization, and nonuse or deferred grazing during the growing season. Reseeding and mechanical practices are not desirable. Capability subclass VIIs; Steep Shallow range site.

DMD—Deleco-Monue association, sloping. This map unit occurs as several areas south and east of Douglas Mesa between Mexican Hat and Oljeto Trading Post. It is on broad, rolling ridges and benches at elevations of 5,000 to 5,800 feet. Deleco fine sand, 2 to 12 percent slopes, makes up about 50 percent of the unit. It generally is in the more sloping areas. Monue loamy fine sand, 1 to 8 percent slopes, makes up about 30 percent. It generally is in the flatter areas.

Included with this unit in mapping are small areas of Sheppard fine sand, hummocky, and Rock outcrop.

Both Deleco and Monue soils formed in mixed eolian deposits and alluvium. The average annual precipitation is about 7 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 160 days.

The Deleco soil is shallow over a lime-cemented hardpan and is well drained. In a typical profile the surface layer is red fine sand about 9 inches thick. Below this is about 8 inches of pink gravelly fine sandy loam that is 40 percent gravel, mainly caliche fragments. The underlying material is a pinkish white very strongly cemented lime hardpan. Sandstone bedrock is at a depth of about 25 inches. The soil is strongly or very strongly alkaline. The depth to the hardpan is 10 to 20 inches.

Permeability is moderately rapid above the hardpan. The effective rooting depth is 10 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

The Monue soil is deep and well drained. In a typical profile the surface layer is yellowish red loamy fine sand 13 inches thick. The subsoil is yellowish red very fine sandy loam 9 inches thick. The upper part of the substratum is pink very fine sandy loam 9 inches thick, and the lower part is yellowish red fine sandy loam. Weathered sandstone and shale are at a depth of 46 inches. The soil ranges from moderately to very strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 40 to 60 inches, and the available water capacity is moderately low or moderate. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is high for wind and moderate for water.

The Deleco and Monue soils are used as range and wildlife habitat. The potential native vegetation on the Deleco soil is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, blackbrush, and black sagebrush. The potential annual yield of air-dry herbage is about 500 pounds per acre in favorable years and 250 pounds in unfavorable years. The potential native vegetation on the Monue soil is blue grama, black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 600 pounds per acre in favorable years and 300 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Both soils in capability subclass VIIs; Deleco soil in Calcareous range site, precipitation zone 1; Monue soil in Sandy range site, precipitation zone 1.

DND—Deleco-Nakai-Rock outcrop association, sloping. This map unit is on the tops of Oljeto Mesa, Nakai Mesa, and Cummings Mesa. It is on gently sloping to rolling mesa tops at elevations of 6,000 to 6,400 feet. Deleco sandy loam, 2 to 12 percent slopes, makes up about 65 percent of the unit. It is generally in the more sloping areas. Nakai very fine sandy loam, 2 to 6 percent slopes, makes up about 20 percent of the unit. It is generally in the flatter areas. Scattered Rock outcrop throughout the unit makes up about 15 percent.

The Deleco and Nakai soils formed in mixed alluvium and eolian deposits. The average annual precipitation is about 8 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 150 days.

The Deleco soil is shallow over a lime-cemented hardpan and is well drained. In a typical profile the surface layer is yellowish red sandy loam about 3 inches thick. Below this is about 6 inches of reddish yellow gravelly sandy clay loam that is 40 to 50 percent caliche fragments and lime nodules. The underlying material is pink very gravelly sandy loam that is 70 to 80 percent caliche fragments and lime nodules. A very strongly cemented lime hardpan is at a depth of about 14 inches. The soil is strongly or very strongly alkaline. The depth to the hardpan is 10 to 20 inches.

Permeability is moderate to rapid above the hardpan. The effective rooting depth is 10 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

The Nakai soil is deep and very deep and well drained. In a typical profile the surface layer is red very fine sandy loam about 3 inches thick. Below this is about 24 inches of red or reddish yellow very fine sandy loam and about 30 inches of pink very fine sandy loam. The underlying material to a depth of about 66 inches is reddish yellow loamy fine sand. The soil is moderately to strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is about 60 inches, and the available water capacity is moderate or moderately high. The organic matter content is very low in the surface layer. Runoff is medium. The erosion hazard is high for wind and moderate for water.

The Rock outcrop is exposed sandstone. It is mostly barren and is not suitable for grazing.

The Deleco and Nakai soils are used as range and wildlife habitat. The potential native vegetation on the Deleco soil is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, blackbrush, and black sagebrush. The potential annual yield of air-dry herbage is about 480 pounds per acre in favorable years and 240 pounds in unfavorable years.

The potential native vegetation on the Nakai soil is black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 600 pounds per acre in favorable years and 300 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Deleco and Nakai soils in capability subclass VIIs, Rock outcrop in capability class VIII; Deleco soil in Calcareous range site, precipitation zone 2; Nakai soil in Sandy range site.

GoB—Gotho fine sandy loam, 1 to 8 percent slopes. This soil is very deep and well drained. It is on the narrow alluvial valley bottoms along two narrow valleys southeast of McCracken Mesa in the northeastern part of the survey area. Elevations are 4,800 to 5,400 feet. This soil formed in mixed alluvium derived from sedimentary rock.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 155 days. Slopes are medium to long.

Included with this soil in mapping are small areas of Tohona sandy clay loam, 1 to 12 percent slopes, and Rock outcrop.

In a typical profile the surface layer is reddish brown fine sandy loam about 6 inches thick. Below this is about 18 inches of light reddish brown heavy very fine sandy loam and about 14 inches of reddish yellow heavy very

fine sandy loam. The underlying material to a depth of 60 inches or more is light reddish brown loam. The soil is strongly or very strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high or high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, blue grama, galleta, fourwing saltbush, bud sagebrush, and shadscale. The potential annual yield of air-dry herbage is about 700 pounds per acre in favorable years and 350 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate a system of deferred-rotation grazing, and interseeding with Indian ricegrass or sand dropseed in carefully selected areas. Capability subclass VIIc; Loamy range site, precipitation zone 1.

GtA—Gotho soils, 0 to 3 percent slopes. This map unit is about equal amounts of Gotho clay, 0 to 3 percent slopes, and Gotho sandy clay loam, 0 to 3 percent slopes. It occurs as long, narrow alluvial valley bottoms along Gothic Creek in the south central part of the survey area. Elevations are 4,600 to 5,200 feet.

These soils formed in mixed alluvium derived from sedimentary rock. The average annual precipitation is about 7 inches. The mean annual temperature is about 54 degrees F, and the average frost-free season is about 155 days.

Included with these soils in mapping are small areas of Sheppard loamy fine sand and a deep, fine textured, very strongly alkaline soil.

These soils are very deep and well drained. In a typical profile of Gotho clay the surface layer is red light clay about 4 inches thick. Below this is about 12 inches of yellowish red light clay. The underlying material to a depth of 60 inches or more is yellowish red sandy clay loam.

Gotho sandy clay loam is similar to Gotho clay but the texture of the surface layer has been modified by wind-deposited material and is sandy clay loam. Both soils are strongly or very strongly alkaline.

In both soils permeability is slow or very slow. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high or high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

These soils are used as range and wildlife habitat. The potential native vegetation is inland saltgrass, alkali sacaton, western wheatgrass, galleta, black greasewood, shadscale, and Nuttall saltbush. The potential annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 425 pounds in unfavorable years.

Suggested range management practices are fencing, winter utilization, and deferred-rotation grazing or nonuse during the growing season. Water spreading may be feasible in some selected areas. In such areas seeding of alkali sacaton or tall wheatgrass is suggested. Capability subclass VIIc; Saline Lowland range site, precipitation zone 1.

HaD—Hoskinnini very fine sandy loam, very shallow, 2 to 5 percent slopes. This soil is very shallow or shallow and well drained. It is on dissected pediments at elevations of 3,900 to 4,200 feet east of and adjacent to Monitor Mesa in the west-central part of the survey area. It formed in residuum derived from sandstone and shale.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 160 days. Slopes are short or medium.

Included with this soil in mapping are small areas of Rock outcrop.

In a typical profile the surface layer is reddish brown very fine sandy loam about 4 inches thick. The subsoil is red gravelly fine sandy loam. Sandstone bedrock is at a depth of about 11 inches.

The soil is moderately or strongly alkaline. The depth to bedrock ranges from 8 to 20 inches.

Permeability above the bedrock is moderate. The effective rooting depth is 8 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is rapid. The erosion hazard is high.

This soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, alkali sacaton, shadscale, and blackbrush. The potential annual yield of air-dry herbage is 250 pounds per acre in favorable years and 125 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate grazing control, winter utilization, and deferred grazing or nonuse during the growing season. Seeding or mechanical practices are not feasible. Capability subclass VIIs; Very Shallow range site, precipitation zone 1.

HmD—Hoskinnini-Rock outcrop complex, 2 to 8 percent slopes. This map unit is in several areas in the vicinity of Hoskinnini Mesa and Monitor Mesa (fig. 3). It is on dissected pediments at elevations of 3,900 to 4,800 feet. Hoskinnini gravelly fine sandy loam, 2 to 8 percent slopes, makes up about 60 percent of the unit, Rock outcrop about 25 percent, and other soils about 15 percent. The Rock outcrop is scattered throughout the unit.

The Hoskinnini soil formed in residuum derived from sandstone and shale. The average annual precipitation is about 8 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 155 days.

The Hoskinnini soil is shallow over sandstone bedrock and is well drained. In a typical profile the surface layer is light red gravelly fine sandy loam about one inch thick. The subsoil is red gravelly fine sandy loam about 7 inches thick and is about 25 percent caliche fragments. The substratum is pink fine sandy loam. Sandstone bedrock is at a depth of about 12 inches. The soil is moderately or strongly alkaline. The depth to bedrock ranges from 8 to 20 inches.

Permeability above the bedrock is moderate. The effective rooting depth is 8 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is rapid. The erosion hazard is high.

The Rock outcrop consists of exposed sandstone bedrock with some interbedded shale.

The Hoskinnini soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, alkali sacaton, shadscale, and blackbrush. The potential annual yield of air-dry herbage is about 350 pounds per acre in favorable years and 175 pounds in unfavorable years.

Suggested range management practices are fencing to facilitate grazing control, winter utilization, and deferred-rotation grazing or nonuse during the growing season. Hoskinnini soil in capability subclass VIIs; Shallow range site, precipitation zone 1.

LAG—Lithic Torriorthents-Typic Torriorthents-Rock outcrop association, steep. This map unit is in scattered areas throughout the western half of the survey area. It is steep to very steep mesa side slopes and canyon walls at elevations of 4,780 to 6,500 feet. The Lithic Torriorthents and Typic Torriorthents each make up about 30 percent of the unit, and Rock outcrop makes up about 25 percent.

Included with this unit in mapping are small areas of Badland and some other soils.

Lithic Torriorthents and Typic Torriorthents formed in residuum and colluvium derived from sedimentary rock. The average annual precipitation is about 9 inches. The mean annual air temperature is about 53 degrees F, and the average frost-free season is about 150 days.

The Lithic Torriorthents are very shallow and well drained. In a typical profile the surface layer is yellowish red fine sandy loam. Unweathered bedrock is at a depth of about 5 inches. These soils are moderately to strongly alkaline. Slopes are 40 to 80 percent. Permeability is rapid above the bedrock. Surface runoff is very rapid and the erosion hazard is very high.

Typic Torriorthents are moderately deep and well drained. Texture ranges from loam to loamy fine sand. Weathered bedrock is at a depth of 20 to 40 inches. The soils are moderately or strongly alkaline. Slopes are 40 to 80 percent. Permeability is moderately rapid or rapid. The available water capacity is low. Surface runoff is very rapid, and the erosion hazard is very high.

The Rock outcrop consists of exposed sandstone and shale bedrock.

This unit is used for water supply and as a scenic attraction. It contains the monuments and small mesa of Monument Valley. Capability class VIII.

LLG—Lithic Torriorthents-Rock outcrop, limestone complex, steep. This map unit is on Raplee Ridge east of Mexican Hat. It is on dissected mountain slopes at elevations of 4,200 to 5,500 feet. The Lithic Torriorthents, about 50 percent of the unit, are mainly in the less sloping areas, where slopes are about 12 to 40 percent. The Rock outcrop, about 30 percent of the unit, is mostly limestone. It is generally in the steeper areas, where slopes are about 25 to 55 percent.

Included in mapping with this unit are other shallow or moderately deep soils.

Lithic Torriorthents formed in residuum derived from limestone. The average annual precipitation is about 8 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 150 days.

Lithic Torriorthents are very shallow or shallow and well drained. In a typical profile the surface layer is reddish brown loam. Limestone bedrock is at a depth of about 8 inches. The depth to bedrock ranges from 4 to 16 inches.

Permeability is moderate above the bedrock. The effective rooting depth is 4 to 16 inches, and the available water capacity is very low or low. The organic matter content is very low in the surface layer. Surface runoff is rapid. The erosion hazard is high.

The Rock outcrop consists of exposed limestone.

The Lithic Torriorthents are used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, alkali sacaton, shadscale, and blackbrush. The potential annual yield of air-dry herbage is about 250 pounds per acre in favorable years and 125 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate grazing control, winter utilization, and deferred-rotation grazing or nonuse during growing season. Lithic Torriorthents in capability subclass VIIs; Very Shallow range site, precipitation zone 1.

MaE—Mespun fine sand, 2 to 10 percent slopes. This soil is very deep or deep and excessively drained. It is on the undulating, broad top of Piute Mesa in the west-central part of the survey area. Elevations are 5,800 to 6,400 feet. This soil formed in eolian deposits derived mainly from sandstone.

The average annual precipitation is about 12 inches. The mean annual air temperature is about 47 degrees F, and the average frost-free season is about 120 days. Slopes are long.

Included with this soil in mapping are small areas of Sogzie very fine sandy loam, 1 to 8 percent slopes, and Shedado loamy fine sand, 1 to 8 percent slopes. Also included are small areas of slightly steeper Mespun soils.

In a typical profile the surface layer is yellowish red fine sand about 18 inches thick. The underlying material to a depth of 60 inches or more is reddish brown loamy fine sand. The soil is neutral to moderately alkaline.

Permeability is rapid. The available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is slight for water and moderate or high for wind.

This soil is used as range and wildlife habitat. The potential native vegetation is blue grama, galleta, needleandthread, big sagebrush, Mormon-tea, sand sagebrush, shadscale, pinyon pine, and Utah juniper. The potential

annual yield of air-dry herbage is about 1,000 pounds per acre in favorable years and 500 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate rest-rotation grazing, reseeding with crested wheatgrass in selected areas, and where needed, chemical or mechanical treatment to control undesirable vegetation. Capability subclass VIIs; Sands range site, precipitation zone 3.

MbD—Moenkopie sandy loam, 3 to 8 percent slopes. This soil is shallow or very shallow and is well drained. It occurs in scattered areas south and east of Mexican Hat, from Chinle Creek to just west of Gypsum Creek, in the central part of the survey area. It is on broad, rolling uplands at elevations of 4,700 to 5,200 feet. This soil formed in residuum derived from sandstone and shale.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are short or medium.

Included with this soil in mapping are small areas of Moenkopie loam and small, scattered areas of Rock outcrop.

In a typical profile the surface layer is red sandy loam about 6 inches thick. It has a surface pavement of angular sandstone gravel. The underlying layer is red silt loam that is about 5 percent angular sandstone gravel. Weathered sandstone and shale bedrock is at a depth of about 15 inches. The soil is moderately alkaline. The depth to bedrock ranges from 5 to 20 inches.

Permeability above the bedrock is moderately rapid. The effective rooting depth is 5 to 20 inches, and the available water capacity is very low or low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is galleta, Indian ricegrass, blue grama, alkali sacaton, shadscale, fourwing saltbush, and Mormon-tea. The potential annual yield of air-dry herbage is about 500 pounds per acre in favorable years and 250 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate grazing control, winter utilization, and deferred grazing or nonuse during the growing season. Seeding or mechanical practices are not feasible. Capability subclass VIIs; Shallow range site, precipitation zone 1.

McF—Moenkopie-Rock outcrop complex, 8 to 25 percent slopes. This map unit occurs just south of Mexican Hat in the central part of the survey area. It is on rolling uplands and in hilly areas at elevations of 4,600 to 5,500 feet. Moenkopie fine sandy loam, 8 to 25 percent slopes, makes up about 65 percent of the unit; Rock outcrop about 25 percent; and Moenkopie loam, 3 to 8 percent slopes, and other included soils about 10 percent. The Rock outcrop is scattered throughout the map unit and occurs on slopes of as much as 55 percent or more.

The Moenkopie soil is shallow or very shallow over weathered sandstone and shale bedrock. It is well drained. In a typical profile the surface layer is red fine sandy loam about 6 inches thick and has a surface pavement of angular sandstone gravel. The underlying layer is red silt loam that is about 5 percent angular sandstone gravel. Weathered sandstone and shale bedrock is at a depth of about 12 inches. The soil is moderately alkaline. The depth to bedrock ranges from 5 to 20 inches.

Permeability is moderate above the bedrock. The effective rooting depth is 5 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is rapid. The erosion hazard is high.

The Rock outcrop consists of exposed interbedded sandstone and shale bedrock.

The Moenkopie soil is used as range and wildlife habitat. The potential native vegetation is galleta, Indian ricegrass, blue grama, alkali sacaton, shadscale, fourwing saltbush, and Mormon-tea. The potential annual yield of air-dry herbage is about 400 pounds per acre in favorable years and 200 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate grazing control, winter utilization, deferred-rotation grazing, or nonuse during the growing season. Moenkopie soil in capability subclass VIIs; Shallow range site, precipitation zone 1.

MeD—Moepitz very fine sand, 3 to 8 percent slopes. This soil is moderately deep and well drained. It is on broad, undulating uplands at elevations of 4,500 to 5,200 feet (fig. 4) in an extensive area to the north and northeast of Navajo Mountain. It formed in mixed alluvium and eolian deposits.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are long.

Included with this soil in mapping are small areas of Sheppard fine sand, hummocky, slightly steeper Moepitz soils, and Rock outcrop.

In a typical profile (fig. 5) the surface layer is reddish yellow very fine sand about 10 inches thick. The underlying layer is reddish yellow very fine sandy loam. Sandstone bedrock is at a depth of about 30 inches. The soil is moderately alkaline. The depth to bedrock ranges from 24 to 40 inches.

Permeability is moderately rapid. The effective rooting depth is 24 to 40 inches, and the available water capacity is low or moderately low. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

This soil is used as range and wildlife habitat. The potential native vegetation is black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indi-

an ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Sandy range site, precipitation zone 1.

MFD—Moepitz-Monue association, gently sloping. This map unit is in an area adjacent to and northeast of Train Rock in the west-central part of the survey area. It is on broad, gently sloping uplands at elevations of 4,800 to 5,200 feet. Moepitz gravelly loamy fine sand, 1 to 6 percent slopes, makes up about 60 percent of the unit. It is in the flatter areas of the unit. Monue loamy fine sand, 1 to 8 percent slopes, makes up about 25 percent. It is in the more sloping areas and is more influenced by wind deposits.

Included with this unit in mapping are small areas of Deleco fine sand, 2 to 12 percent slopes, and Rock outcrop.

Both Moepitz and Monue soils formed in mixed alluvium and eolian deposits derived from sedimentary rock. The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days.

The Moepitz soil is moderately deep and well drained. In a typical profile the surface layer is red gravelly loamy fine sand about 10 inches thick. The underlying layer is red fine sandy loam. Weathered shale is at a depth of about 36 inches. The soil is strongly or very strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 24 to 40 inches, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

The Monue soil is deep and well drained. In a typical profile the surface layer is yellowish red loamy fine sand about 13 inches thick. The subsoil is yellowish red very fine sandy loam about 11 inches thick. The upper part of the substratum is pink very fine sandy loam about 11 inches thick, and the lower part is yellowish red fine sandy loam. Weathered shale and sandstone are at a depth of about 46 inches. The soil is moderately to strongly alkaline. The depth to sandstone or shale ranges from 40 to 60 inches.

Permeability is moderately rapid. The effective rooting depth is 40 to 60 inches, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

The Moepitz and Monue soils are used as range and wildlife habitat. The potential vegetation on the Moepitz soil is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, and blackbrush. The potential production is about 500 pounds per acre in favorable years and 250 pounds in unfavorable years.

The potential native vegetation on the Monue soil is blue grama, black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 600 pounds per acre in favorable years and 300 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Both soils in capability subclass VIIs; Moepitz soil in Calcareous range site, precipitation zone 1; Monue soil in Sandy range site, precipitation zone 1.

MhD—Monue-Sheppard complex, 1 to 12 percent slopes. This map unit occurs as two scattered, large areas between Oljeto Mesa and Douglas Mesa in the west-central part of the survey area. It is on broad valley bottoms and sloping uplands at elevations of 4,800 to 5,400 feet. Monue loamy fine sand, 1 to 8 percent slopes, makes up about 50 percent of the unit, and Sheppard fine sand, hummocky, about 30 percent.

Included in mapping with this unit are small areas of Nakai very fine sandy loam and other soils. These included soils make up about 20 percent of the unit.

The Monue soil formed in mixed alluvium and eolian deposits derived from sedimentary rock. The Sheppard soil formed in eolian deposits derived mainly from sandstone. The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days.

The Monue soil is deep and well drained. In a typical profile the surface layer is yellowish red loamy fine sand about 13 inches thick. The subsoil is yellowish red very fine sandy loam about 11 inches thick. The upper 11 inches of the substratum is pink very fine sandy loam. The lower part is yellowish red fine sandy loam. Weathered shale and sandstone is at a depth of about 46 inches. The soil is moderately to strongly alkaline. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately rapid. The effective rooting depth is 40 to 60 inches, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is moderate for water and high for wind.

The Sheppard soil is very deep and somewhat excessively drained. In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. Below this is reddish yellow loamy fine sand to fine sand to a depth of 60 inches or more. The soil is mildly or moderately alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is very high for wind and slight for water.

The Monue and Sheppard soils are used as range and wildlife habitat. The potential native vegetation on the Monue soil is black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

The potential native vegetation on the Sheppard soil is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The

potential annual yield of air-dry herbage is about 575 pounds per acre in favorable years and 275 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Both soils in capability subclass VIIs; Monue soil in Sandy range site, precipitation zone 1; Sheppard soil in Choppy Sand range site, precipitation zone 1.

MoB—Mota loamy fine sand, 1 to 8 percent slopes. This soil is very deep and well drained. It is on undulating uplands and benches in several scattered areas south of the San Juan River in the east-central part of the survey area. Elevations are 4,800 to 5,400 feet. This soil formed in eolian deposits derived mainly from sandstone.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 150 days. Slopes are long.

Included with this soil in mapping are small areas of Nakai loamy fine sand, 1 to 8 percent slopes; shallow sandy soils; and Rock outcrop.

In a typical profile the surface layer is yellowish red loamy fine sand about 6 inches thick. Below this is 17 inches of gray very fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy very fine sand. The soil is strongly or very strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

This soil is used as range and wildlife habitat. The potential native vegetation is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, and blackbrush. The potential annual yield of air-dry herbage is about 500 pounds per acre in favorable years and 250 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIe; Calcareous range site, precipitation zone 1.

MRE—Mota-Moenkopie-Rock outcrop association, sloping. This map unit occurs as a large area between Comb Ridge and Gothic Creek in the central part of the survey area. It is in a broad basin valley at elevations of 4,600 to 5,000 feet. Mota loamy fine sand, 1 to 8 percent slopes, makes up about 30 percent of the unit. It is generally in the flatter, protected areas where eolian deposits can accumulate. Moenkopie sandy loam, 8 to 25 percent slopes, makes up about 30 percent. It is generally in the steeper, more eroded areas. Scattered Rock outcrop throughout the unit makes up about 15 percent.

Included with this unit in mapping are small areas of shallow and moderately deep sandy soils.

The Mota soil formed in eolian deposits, and the Moenkopie soil formed in residuum from sandstone and shale.

The average annual precipitation is about 7 inches. Mean annual air temperature is about 55 degrees F, and the average frost-free season is about 160 days.

The Mota soil is very deep and well drained. In a typical profile the surface layer is yellowish red loamy fine sand about 6 inches thick. Below this is about 17 inches of pinkish gray very fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy very fine sand. The soil is strongly or very strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

The Moenkopie soil is shallow or very shallow over weathered sandstone and shale bedrock. It is well drained. In a typical profile the surface layer is red sandy loam about 6 inches thick and has a surface pavement of angular sandstone gravel. Below this is red silt loam that is about 5 percent angular sandstone gravel. Weathered sandstone and shale bedrock is at a depth of about 15 inches. The soil is moderately or strongly alkaline. The depth to bedrock ranges from 5 to 20 inches.

Permeability is moderate above the bedrock. The effective rooting depth is 5 to 20 inches, and the available water capacity is very low or low. The organic matter content is very low in the surface layer. Surface runoff is moderate. The erosion hazard is high.

The Rock outcrop consists of exposed interbedded sandstone and shale.

The Mota and Moenkopie soils are used as range and wildlife habitat. The potential native vegetation on the Mota soil is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, and blackbrush. The potential annual yield of air-dry herbage is about 500 pounds per acre in favorable years and 250 pounds in unfavorable years.

Suggested range management practices for the Mota soil are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas.

The potential native vegetation on the Moenkopie soil is galleta, Indian ricegrass, alkali sacaton, shadscale, fourwing saltbush, and Mormon-tea. The potential annual yield of air-dry herbage is about 400 pounds per acre in favorable years and 200 pounds in unfavorable years.

Suggested range management practices for the Moenkopie soil are fencing, cross fencing to facilitate grazing control, winter utilization, and deferred-rotation grazing or nonuse during the growing season. Mota soil in capability subclass VIIe, Calcareous range site, precipitation zone 1; Moenkopie soil in capability subclass VIIs, Shallow range site, precipitation zone 1; Rock outcrop in capability subclass VIII.

NaB—Nakai loamy fine sand, 1 to 8 percent slopes. This soil is on several river terraces adjacent to the San Juan River between the community of Montezuma Creek and the Colorado state line. Elevations are 4,500 to 4,800 feet. This soil formed in mixed alluvium and eolian deposits derived from sedimentary rock.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are medium or long.

Included with this soil in mapping are small areas of Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes; and Sheppard fine sand, hummocky.

In a typical profile the surface layer is yellowish red loamy fine sand about 18 inches thick. Below this is about 8 inches of yellowish red fine sandy loam and about 8 inches of pinkish white very fine sandy loam. The underlying material to a depth of 60 inches or more is pink loamy fine sand. The soil is moderately or strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

This soil is used as range and wildlife habitat. The potential native vegetation is black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Sandy range site, precipitation zone 1.

NbC—Nakai very fine sandy loam, 2 to 6 percent slopes. This soil is very deep and well drained. It is on broad undulating valleys and uplands at elevations of 4,800 to 5,500 feet in several broad areas in the central part of Monument Valley. It formed in mixed eolian deposits and alluvium derived from sedimentary rock.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are long.

Included with this soil in mapping are small areas of Monue loamy fine sand, 1 to 8 percent slopes, and Deleco fine sand, 2 to 12 percent slopes.

In a typical profile the surface layer is red very fine sandy loam about 3 inches thick. Below this is about 27 inches of red or reddish yellow very fine sandy loam and about 24 inches of pink very fine sandy loam. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is moderately or strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. Surface runoff is slow to medium. The erosion hazard is moderate for water and high for wind.

This soil is used as range and wildlife habitat. The potential native vegetation is black grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Sandy range site, precipitation zone 1.

NCF—Namon-Rock outcrop complex, 3 to 25 percent slopes. This map unit is on the top part of Navajo Mountain. It is on plateaus and mountain slopes at elevations of 8,800 to 10,300 feet. Namon very cobbly very fine sandy loam, 3 to 25 percent slopes, makes up about 55 percent of the unit; Rock outcrop about 30 percent; and other soils 15 percent.

The Namon soil is deep and well drained. It formed in residuum and colluvium derived from sandstone and shale. The average annual precipitation is about 20 inches. The mean annual air temperature is about 40 degrees F, and the average frost-free season is about 80 days.

In a typical profile the surface layer is dark brown very cobbly very fine sandy loam about 5 inches thick. The subsurface layer is light reddish brown cobbly very fine sandy loam about 16 inches thick. The upper part of the subsoil is pink very cobbly very fine sandy loam about 12 inches thick, and the lower part is light brown very cobbly very fine sandy loam. Sandstone bedrock is at a depth of about 48 inches. The soil is neutral or mildly alkaline. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately rapid. The effective rooting depth is 40 to 60 inches, and the available water capacity is moderately low. The organic matter content is moderate in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

The Rock outcrop is mostly exposed sandstone and some interbedded shale bedrock.

The Namon soil is used as range and wildlife habitat. The potential native vegetation is needlegrass, sedge, bluegrass, big sagebrush, snowberry, ponderosa pine, spruce, fir, and quaking aspen. The potential annual yield of air-dry herbage is 1,500 pounds per acre in favorable years and 1,200 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and water development. Namon soil in capability subclass VIIs; Loamy range site, precipitation zone 6.

NDG—Namon-Rock outcrop complex, low rainfall, 25 to 55 percent slopes. This map unit is on the intermediate slopes of Navajo Mountain at elevations of 7,600 to 8,800 feet. Namon very cobbly very fine sandy loam, low rainfall, 25 to 55 percent slopes, makes up about 50 percent of the unit; Rock outcrop about 30 percent; and other soils about 20 percent.

The Namon soil is deep and well drained. It formed in residuum and colluvium derived from sandstone and shale. The average annual precipitation is about 17 inches. The mean annual air temperature is about 40 degrees F, and the average frost-free season is about 80 days.

In a typical profile the surface layer is dark brown very cobbly very fine sandy loam about 5 inches thick. The subsurface layer is light reddish brown cobbly very

fine sandy loam about 16 inches thick. The upper part of the subsoil is pink very cobbly very fine sandy loam about 12 inches thick, and the lower part is light brown very cobbly very fine sandy loam. Sandstone bedrock is at a depth of about 48 inches. The soil is neutral or mildly alkaline. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately rapid. The effective rooting depth is 40 to 60 inches, and the available water capacity is moderately low. The organic matter content is moderate in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

The Rock outcrop is mostly exposed sandstone and some interbedded shale bedrock.

The Namon soil is used as range and wildlife habitat. The potential native vegetation is needlegrass, sedge, bluegrass, big sagebrush, ponderosa pine, and quaking aspen. The potential annual yield of air-dry herbage is about 1,200 pounds per acre in favorable years and 800 pounds in unfavorable years.

Suggested range management practices are fencing to facilitate a system of rest-rotation grazing and water development. Namon soil in capability subclass VIIs; Loamy range site, precipitation zone 5.

NkD—Nepalto very fine sandy loam, 2 to 8 percent slopes. This soil is very deep and somewhat excessively drained. It is on alluvial fans of Oljeto Wash and its tributaries between Oljeto Mesa and Hoskinnini Mesa west of Monument Valley. Elevations are 4,800 to 5,200 feet. This soil formed in mixed alluvium derived from sedimentary rock. It is subject to occasional flash flooding.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 150 days. Slopes are medium or long.

Included with this soil in mapping are small areas of Neskahi fine sandy loam, 2 to 6 percent slopes, and Pickrell loamy fine sand, 2 to 6 percent slopes.

In a typical profile the surface layer is red very fine sandy loam about 12 inches thick. Below this is about 19 inches of red gravelly loamy fine sand. The underlying material to a depth of 60 inches or more is reddish brown very gravelly sand. The soil is moderately or strongly alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, sand dropseed, blackbrush, fourwing saltbush, shadscale, and Mormon-tea. The potential annual yield of air-dry herbage is about 800 pounds per acre in favorable years and 400 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Calcareous range site, precipitation zone 1.

NnD—Neskahi fine sandy loam, 2 to 6 percent slopes. This soil is very deep and well drained. It is on broad valley bottoms and alluvial fans at elevations of 4,700 to 5,200 feet in two areas in the central and eastern parts of Monument Valley. It formed in mixed eolian deposits and alluvium derived from sedimentary rocks.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are long.

Included with this soil in mapping are small areas of Nakai very fine sandy loam, 2 to 6 percent slopes; Monue fine sand, 1 to 8 percent slopes; and Deleco fine sand, 2 to 12 percent slopes.

In a typical profile the surface layer is red fine sandy loam about 6 inches thick. Below this is about 15 inches of red very fine sandy loam and about 21 inches of light red loam. The underlying material to a depth of 60 inches or more is light red silt loam. The soil is moderately or strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, sand dropseed, blackbrush, fourwing saltbush, shadscale, and Mormon-tea. The potential annual yield of air-dry herbage is about 800 pounds per acre in favorable years and 400 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Calcareous range site, precipitation zone 1.

NOC—Neskahi-Oljeto association, sloping. This map unit occurs in a valley south and west of Holiday Mesa, directly west of Oljeto Trading Post. It is in a broad undulating valley at elevations of 5,000 to 5,200 feet. Neskahi loamy fine sand, 1 to 5 percent slopes (fig. 6), makes up about 50 percent of the unit. It generally is on the less sloping valley bottoms between alluvial fans. Oljeto loamy fine sand, 2 to 8 percent slopes, makes up about 25 percent. It generally is on the alluvial fans.

Included with this unit in mapping are small areas of Sheppard fine sand, hummocky, and other deep sandy soils.

Both Neskahi and Oljeto soils formed in alluvium derived from sedimentary rock. The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days.

The Neskahi soil is very deep and well drained. In a typical profile the surface layer is reddish yellow loamy fine sand about 6 inches thick. Below this is about 29 inches of yellowish red very fine sandy loam. The underlying material to a depth of 60 inches or more is yellowish red fine sandy loam. The soil is moderately or strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

The Oljeto soil is very deep and somewhat excessively drained. In a typical profile the surface layer is red loamy fine sand about 20 inches thick. Below this is about 20 inches of light red very gravelly loamy coarse sand. The underlying material to a depth of 60 inches or more is red very gravelly loamy sand. The soil is mildly to strongly alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

The Neskahi and Oljeto soils are used as range and wildlife habitat. The potential native vegetation on the Neskahi soil is blue grama, galleta, Indian ricegrass, needleandthread, sand dropseed, Mormon-tea, and fourwing saltbush. The potential annual yield of air-dry herbage is about 600 pounds per acre in favorable years and 300 pounds in unfavorable years.

The potential native vegetation on the Oljeto soil is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, blackbrush, and Mormon-tea. The potential annual yield of air-dry herbage is about 500 pounds per acre in favorable years and 250 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Neskahi soil in capability subclass VIIe, Sandy range site, precipitation zone 1; Oljeto soil in capability subclass VIIs, Calcareous range site, precipitation zone 1.

OJD—Oljeto-Sheppard association, sloping. This map unit occurs in the canyon to the south of Holiday Mesa and adjacent to the northeast side of Oljeto Mesa. It is on old alluvial fans and terraces at elevations of 4,800 to 5,300 feet. Oljeto loamy fine sand, 2 to 8 percent slopes, makes up about 55 percent of the unit. It is mainly in areas where recent wind deposits have had little influence on the soil. Sheppard fine sand, hummocky, makes up about 25 percent. It is in the areas that are exposed to wind deposition.

Included with this unit in mapping are small areas of Pickrell loamy fine sand, 2 to 6 percent slopes, and other sandy soils.

The Oljeto soil formed in mixed alluvium, and the Sheppard soil formed in mixed eolian material; both the alluvium and the eolian material were derived from sedimentary rock. The average annual precipitation is about 8 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days.

The Oljeto soil is very deep and somewhat excessively drained. In a typical profile the surface layer is red loamy fine sand about 20 inches thick. Below this is about 20 inches of light red very gravelly loamy coarse sand. The underlying material to a depth of 60 inches or more is red very gravelly loamy sand. The soil is mildly to strongly alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

The Sheppard soil is very deep and somewhat excessively drained. In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is mildly or moderately alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is very high for wind and slight for water.

The Oljeto and Sheppard soils are used as range and wildlife habitat. The potential native vegetation on the Oljeto soil is blue grama, Indian ricegrass, galleta, alkali sacaton, shadscale, blackbrush, and Mormon-tea. The potential annual yield of air-dry herbage is about 500 pounds per acre in favorable years and 250 pounds in unfavorable years.

The potential native vegetation on the Sheppard soil is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage is about 650 pounds per acre in favorable years and 325 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Both soils in capability subclass VIIs; Oljeto soil in Calcareous range site, precipitation zone 1; Sheppard soil in Sands range site, precipitation zone 1.

PcD—Pickrell loamy fine sand, 2 to 6 percent slopes. This soil is shallow and well drained. It is on benches and mesas in a line of scattered areas that extends from Organ Rock Bench near Oljeta Mesa northward to the San Juan River. Elevations are 4,800 to 5,500 feet. This soil formed in mixed eolian deposits and residuum derived from sandstone.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are medium or long.

Included with this soil in mapping are small areas of Piute loamy sand and other shallow to moderately deep sandy soils.

In a typical profile the surface layer is yellowish red fine sand and loamy fine sand about 5 inches thick. The subsoil is yellowish red loamy fine sand about 7 inches thick. The substratum is pink gravelly loamy fine sand that is about 30 percent lime nodules. Sandstone bedrock is at a depth of about 18 inches. The soil is moderately or strongly alkaline. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderately rapid above the bedrock. The effective rooting depth is 12 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate for water and high for wind.

This soil is used as range and wildlife habitat. The potential native vegetation is galleta, Indian ricegrass, blue grama, alkali sacaton, shadscale, fourwing saltbush, and Mormon-tea. The potential annual yield of air-dry herbage is about 400 pounds per acre in favorable years and 200 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate grazing control, winter utilization, and deferred-rotation grazing or nonuse during the growing season. Capability subclass VIIs; Shallow range site, precipitation zone 1.

PrE—Piute-Rock outcrop complex, 3 to 25 percent slopes. This map unit occurs as several areas on Piute Mesa and west of Piute Creek in the western part of the survey area. It is on rolling uplands at elevations of 4,600 to 5,800 feet (fig. 7). Piute loamy fine sand, 3 to 25 percent slopes, makes up about 50 percent of the unit and Rock outcrop about 30 percent.

Included with this unit in mapping are small areas of Moepitz fine sand, 3 to 12 percent slopes; Sheppard fine sand, hummocky; and Badland.

The Piute soil formed in eolian deposits and residuum derived from sandstone. The average annual precipitation is about 8 inches. The mean annual air temperature is about 52 degrees F, and the average frost-free season is about 150 days. Slopes are medium or long.

The Piute soil is very shallow and is well drained. In a typical profile the surface layer is yellowish red loamy fine sand. Sandstone bedrock is at a depth of about 9 inches. The soil is mildly or moderately alkaline. The depth to bedrock ranges from 7 to 10 inches.

Permeability is moderately rapid above the bedrock. The effective rooting depth is 7 to 10 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is rapid. The erosion hazard is high.

The Rock outcrop consists of exposed sandstone bedrock that has some interbedded layers of shale.

The Piute soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, blackbrush, shadscale, Mormon-tea, and juniper. The potential annual yield of air-dry herbage is about 300 pounds per acre in favorable years and 150 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate grazing control, winter utilization, and deferred grazing or nonuse during the growing season. Seeding or mechanical practices are not feasible. Piute soil in capability subclass VIIs; Very Shallow range site, precipitation zones 1 and 2.

PsE—Piute-Rock outcrop complex, high rainfall, 3 to 25 percent slopes. This map unit occurs as several areas northeast of Navajo Mountain on Piute Mesa and Hoskinnini Mesa in the western part of the survey area. It is on rolling uplands and broad mesa tops at elevations of 5,800 to 6,500 feet. Piute loamy fine sand, 3 to 25 percent slopes, makes up about 50 percent of the unit and Rock outcrop about 30 percent.

Included with this unit in mapping are small areas of Mespun fine sand, 2 to 10 percent slopes, and other sandy shallow to moderately deep soils.

The Piute soil formed in eolian deposits and residuum derived from sandstone. The average annual precipitation is about 12 inches. The mean annual air temperature is about 47 degrees F, and the average frost-free season is about 120 days. Slopes are medium or long.

The Piute soil is very shallow and well drained. In a typical profile the surface layer is yellowish red loamy fine sand. Sandstone bedrock is at a depth of about 9 inches. The soil is mildly or moderately alkaline. The depth to bedrock ranges from 7 to 10 inches.

Permeability is moderately rapid above the bedrock. The effective rooting depth is 7 to 10 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is rapid. The erosion hazard is high.

The Rock outcrop consists of exposed sandstone bedrock with some interbedded layers of shale.

The Piute soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, blackbrush, shadscale, Mormon-tea, fourwing saltbush, Utah juniper, and pinyon pine. The potential annual yield of air-dry herbage is about 400 pounds per acre in favorable years and 200 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate grazing control, and rest-rotation grazing. Some small selected areas may be suitable for reseeding or mechanical control of undesirable species. Piute soil in capability subclass VIIs; Very Shallow range site, precipitation zone 3.

PY—Playas. This map unit consists of dry lakebeds. Playas are deep, fine textured lake sediments. They are on a slightly concave plain at elevations of 4,900 to 5,000 feet about 5 miles north of Boundary Butte Mesa and 7 miles south of Hogan Mesa in the east-central part of the survey area.

Included with this unit in mapping are small areas of Aneth loamy fine sand and some shallow to moderately deep sandy soils.

Permeability is very slow. Erosion is not a hazard. Because there are no natural drainage outlets, water is occasionally ponded at shallow depths. Salinity and alkalinity are moderate to severe.

Playas are mostly barren. The sparse, scattered vegetation is mainly annual weeds, alkali sacaton, galleta, bluestem, and seepweed. A few areas provide habitat for wildlife. Capability class VII.

RaE—Raplee very fine sandy loam, 2 to 12 percent slopes. This soil is moderately deep and well drained. It occurs as a long, narrow area southeast of Mexican Hat between Gypsum Creek and Comb Ridge. It is on dissected pediments at elevations of 4,700 to 5,000 feet. It formed in residuum derived from gypsiferous sandstone.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are short or medium.

Included with this soil in mapping are small areas of a deep loamy gypsiferous soil and Rock outcrop.

In a typical profile the surface layer is reddish yellow very fine sandy loam about 4 inches thick. The underlying material is reddish yellow very fine sandy loam. Weathered sandstone and shale are at a depth of about 22 inches, and sandstone bedrock is at a depth of about 36 inches. The soil is mildly or moderately alkaline. The depth to consolidated bedrock ranges from 30 to 40 inches.

Permeability is moderately rapid above the bedrock. The effective rooting depth is 20 to 40 inches, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is rapid. The erosion hazard is high.

This soil is used as range and wildlife habitat. The potential native vegetation is alkali sacaton, galleta, western wheatgrass, Indian ricegrass, Nuttall saltbush, shadscale, fourwing saltbush, and blackbrush. The potential annual yield of air-dry herbage is about 300 pounds per acre in favorable years and 150 pounds in unfavorable years.

Suggested range management practices are fencing and rest-rotation grazing. This soil is so easily damaged that mechanical practices should not be applied. Capability subclass VIIs; Saline Upland range site.

RED—Redbank-Shedado association, sloping. This map unit is on the southern part of Piute Mesa in the west-central part of the survey area. It is on a broad undulating mesa top at elevations of 6,100 to 6,400 feet. Redbank very fine sandy loam, 3 to 12 percent slopes, makes up about 55 percent of the unit. It formed in mixed eolian deposits and alluvium. Shedado loamy very fine sand, 3 to 8 percent slopes, makes up about 30 percent of the unit. It formed in mixed eolian deposits and residuum.

Included with this unit in mapping are small areas of other sandy soils and Rock outcrop.

The average annual precipitation is about 12 inches. The mean annual air temperature is about 48 degrees F, and the average frost-free season is about 120 days.

The Redbank soil is very deep and well drained. In a typical profile the surface layer is reddish brown very fine sandy loam about 8 inches thick. Below this is about 20 inches of reddish yellow very fine sandy loam and about 14 inches of reddish yellow loamy fine sand. The underlying material to a depth of 60 inches or more is pink fine sandy loam. The soil is mildly to strongly alkaline.

Permeability is moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

The Shedado soil is moderately deep and well drained. In a typical profile the surface layer is yellowish red loamy very fine sand about 7 inches thick. Below this is about 8 inches of yellowish red very fine sand. The underlying material is reddish brown and yellowish red loamy very fine sand. Sandstone bedrock is at a depth of about 35 inches. The soil is mainly neutral but is mildly alkaline in the lower part in some pedons. The depth to bedrock ranges from 24 to 40 inches.

Permeability is moderately rapid. The effective rooting depth is 24 to 40 inches, and the available water capacity is low. The organic matter content is very low in the surface layer. Runoff is medium. The erosion hazard is moderate.

The Redbank and Shedado soils are used as range and wildlife habitat. The potential vegetation on the Redbank soil is blue grama, black grama, Indian ricegrass, galleta, western wheatgrass, sand dropseed, fourwing saltbush, big sagebrush, and winterfat. The potential annual yield of air-dry herbage is about 1,000 pounds per acre in favorable years and 500 pounds in unfavorable years.

The potential native vegetation on the Shedado soil is Indian ricegrass, black grama, blue grama, sand dropseed, galleta, big sagebrush, winterfat, fourwing saltbush, pinyon pine, and Utah juniper. The potential annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 450 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and chemical or mechanical control of undesirable species in selected areas. Redbank soil in capability subclass VIe, Loamy range site, precipitation zone 3; Shedado soil in capability subclass VIIe, Sandy range site, precipitation zone 3.

RH—Riverwash. This map unit consists of the active stream bed of a large wash, or intermittent stream. It includes recent stream-deposited coarse sands, gravel, cobbles, and stones. It is subject to frequent and damaging overflow or runoff that restricts the growth of most plants. This unit is in the Oljeto Wash in the central part of the survey area.

Riverwash is used only as wildlife habitat and as a disposal channel for floodwaters. Capability class VIII.

RO—Rock outcrop. This map unit consists almost entirely of exposed sandstone bedrock. It occurs mostly on canyon walls and steep breaks in areas adjacent to and

east of Chinle Wash and in two areas along the drainage of Gothic Wash in the central and east-central parts of the survey area.

Included with this unit in mapping are small areas of shale or mudstone bedrock and some shallow or very shallow sandy soils.

Rock outcrop is mostly barren. The vegetation is sparse and is mainly cliffrose, singleleaf ash, littleleaf mountain-mahogany, wavyleaf oak, and roundleaf buffaloberry. These plants survive in the cracks and crevices of the sandstone.

Rock outcrop is scenic. It is used for water supply and limited wildlife habitat. Capability class VIII.

RRG—Rock outcrop, sandstone-Lithic Torriorthents association, steep. This map unit (fig. 8) occurs as numerous, large, scattered areas throughout the central and western parts of the survey area. It is on broad, rolling to steep uplands, ledges, ridges, cliffs, and canyon walls at elevations of 4,400 to 6,500 feet. The Rock outcrop is exposed sandstone bedrock generally in the steeper areas on slopes of more than 25 percent. It generally makes up more than 50 percent of the unit, but the percentage varies from place to place.

The Lithic Torriorthents generally are in the less sloping, protected areas where slopes are 5 to 40 percent. They make up less than 50 percent of the unit. Included with this unit in mapping are small areas of Piute soils and some moderately deep sandy soils.

The Lithic Torriorthents formed in eolian deposits and residuum derived from sandstone. The average annual precipitation is about 7 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 150 days. These soils receive additional moisture as runoff from adjacent areas of Rock outcrop.

The Lithic Torriorthents are very shallow and well drained. In a typical profile the surface layer is reddish yellow fine sandy loam. Sandstone bedrock is at a depth of about 4 inches. The depth to bedrock ranges from 2 to 10 inches.

Permeability is moderately rapid above the bedrock. The effective rooting depth is 2 to 10 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is very rapid. The erosion hazard is very high.

The Lithic Torriorthents are used as range, wildlife habitat, and water supply. The potential native vegetation on these soils is black grama, blue grama, galleta, Indian ricegrass, sand dropseed, Mormon-tea, blackbrush, and black sagebrush. The potential annual yield of air-dry herbage is about 300 pounds per acre in favorable years and 150 pounds in unfavorable years.

A suggested range management practice is rest-rotation grazing. Fencing may not be practical because the soils are scattered areas among the Rock outcrops.

Lithic Torriorthents in capability subclass VIIs; Very Shallow range site, precipitation zone 1; Rock outcrop in capability class VIII.

RSG—Rock outcrop-Moenkopie association, steep. This map unit occurs as a long, narrow area southwest of Mexican Hat and as two large areas on Monitor Mesa and in Nakai Canyon in the west-central part of the survey area. It is on rolling to very steep upland canyon walls (fig. 9) and valley slopes at elevations of 4,000 to 5,400 feet. The Rock outcrop generally is in the steeper areas, on slopes of more than 25 percent. It makes up about 55 percent of the unit. Moenkopie fine sandy loam, 8 to 25 percent slopes, and Moenkopie fine sandy loam, 25 to 55 percent slopes, make up about 25 percent of the unit. Included areas of other soils make up the remaining 20 percent.

The Rock outcrop consists mainly of exposed sandstone bedrock. Some smaller areas are exposed shale or mudstone.

The Moenkopie soils are shallow or very shallow and well drained. They formed in residuum derived from sandstone and shale. The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 150 days. Slopes are short or medium.

In a typical profile the surface layer is red sandy loam about 6 inches thick and has a surface pavement of angular sandstone gravel. The underlying layer is red silt loam. Weathered sandstone and shale bedrock is at a depth of about 12 inches. The soil is moderately alkaline. The depth to bedrock ranges from 5 to 20 inches.

Permeability above the bedrock is moderate. The effective rooting depth is 5 to 20 inches, and the available water capacity is very low. The organic matter content is very low in the surface layer. Surface runoff is moderate. The erosion hazard is moderate to high.

The Moenkopie soil is used as range and wildlife habitat. The potential native vegetation is black grama, blue grama, galleta, Indian ricegrass, shadscale, Mormon-tea, blackbrush, and black sagebrush. The potential annual yield of air-dry herbage is about 300 pounds per acre in favorable years and 150 pounds in unfavorable years.

A suggested range management practice is rest-rotation grazing. Fencing may not be practical because the soils are scattered areas among the Rock outcrops. Moenkopie soil in capability subclass VIIs; Rock outcrop in capability class VIII; both in Thin Breaks range site.

SaE—Shedado loamy fine sand, 1 to 8 percent slopes. This soil is moderately deep and well drained. It occurs on broad mesa tops and undulating uplands at elevations of 6,000 to 6,600 feet, in areas on Piute and Hoskinnini Mesas and an area just east of Navajo Mountain. It formed in eolian deposits and residuum derived from sandstone.

The average annual precipitation is about 12 inches. The mean annual air temperature is about 48 degrees F, and the average frost-free season is about 120 days. Slopes are long.

Included with this soil in mapping are small areas of Piute loamy fine sand, high rainfall, 3 to 25 percent slopes; Mespun fine sand, 2 to 10 percent slopes; Shedado loamy fine sand, 8 to 20 percent slopes; and Rock outcrop.

In a typical profile the surface layer is yellowish red loamy very fine sand about 7 inches thick. Below this is about 8 inches of yellowish red very fine sand. The underlying material is reddish brown and yellowish red loamy very fine sand. Sandstone bedrock is at a depth of about 35 inches. The soil is mainly neutral but is mildly alkaline in the lower part in some pedons. The depth to bedrock ranges from 24 to 40 inches.

Permeability is moderately rapid. The effective rooting depth is 24 to 40 inches, and the available water capacity is low. The organic matter content is very low in the surface layer. Runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, black grama, blue grama, sand dropseed, galleta, big sagebrush, winterfat, fourwing saltbush, pinyon pine, and Utah juniper. The potential annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 450 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and chemical or mechanical control of undesirable species in selected areas. Capability subclass VIIe; Sandy range site, precipitation zone 3.

ShD—Sheppard fine sand, hummocky. This soil is very deep and somewhat excessively drained. It is on undulating uplands in numerous areas from central Monument Valley on the west to the San Juan River on the east. Elevations are 4,400 to 5,500 feet. The soil formed in eolian material derived from sandstone.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 53 degrees F, and the average frost-free season is about 150 days. Slopes are medium or long and are 2 to 8 percent. They are broken by numerous hummocks as much as 2 feet high.

Included with this soil in mapping are small areas of Monue fine sandy loam, 1 to 8 percent slopes; Piute loamy fine sand, 3 to 25 percent slopes; Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes; Sheppard fine sand, rolling; other sandy soils that have bedrock at a depth of 40 to 60 inches; and Rock outcrop.

In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is mildly or moderately alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is high to very high for wind and slight for water.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage is about 650 pounds per acre in favorable years and 325 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Sands range site, precipitation zone 1.

ShE—Sheppard fine sand, rolling. This soil is very deep and somewhat excessively drained. It is on undulating to rolling uplands at elevations of 4,800 to 5,400 feet in three large areas in the east-central part of the survey area. It formed in eolian material derived from sandstone.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 53 degrees F, and the average frost-free season is about 150 days. Slopes are short or medium and are mainly 2 to 8 percent. There are numerous hummocks and dunes as much as 15 feet high.

Included with this soil in mapping are small areas of Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes; Sheppard fine sand, hummocky; and Monue loamy fine sand, 1 to 8 percent slopes.

In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is mildly or moderately alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is very high for wind and slight for water.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage is about 575 pounds per acre in favorable years and 275 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Choppy Sands range site, precipitation zone 1.

SkE—Sheppard fine sand, high rainfall, hummocky. This soil is very deep and somewhat excessively drained. It is on undulating to rolling uplands at elevations of 5,700 to 6,000 feet in a large area on the southern end of Douglas Mesa. It formed in eolian material derived from sandstone.

The average annual precipitation is about 9 inches. The mean annual air temperature is about 52 degrees F, and the average frost-free season is about 140 days. Slopes are medium or long and are 2 to 12 percent. They are broken by numerous hummocks as much as 2 feet high.

Included with this soil in mapping are small areas of other sandy soils that have bedrock at a depth of 40 to 60 inches and areas of Rock outcrop.

In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is mildly alkaline or alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately low. The organic matter content is very low in

the surface layer. Surface runoff is slow. The erosion hazard is high to very high for wind and slight for water.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Sands range site, precipitation zone 2.

SME—Sheppard-Rock outcrop association, hummocky. This map unit occurs as a small area just south of the San Juan River, about 5 miles east of Bluff. It is on undulating to rolling uplands at elevations of 4,400 to 4,800 feet. Sheppard fine sand, hummocky, makes up about 50 percent of the unit. It is generally in the more nearly level areas. Sheppard fine sand, rolling, makes up about 20 percent. It is generally on steeper slopes in areas that are exposed to wind deposition. The Rock outcrop makes up about 20 percent. It is in scattered areas throughout the unit.

Included with this unit in mapping are small areas of Aneth loamy fine sand, 1 to 8 percent slopes; Mota loamy fine sand, 1 to 8 percent slopes; and some other sandy soils that have bedrock at a depth of 40 to 60 inches.

The Sheppard soils formed in eolian material derived from sandstone. The average annual precipitation is about 7 inches. The mean annual air temperature is about 53 degrees F, and the average frost-free season is about 160 days. Slopes are short or medium and are 2 to 12 percent.

The Sheppard soils are very deep and somewhat excessively drained. In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is mildly or moderately alkaline. Texture below a depth of 12 inches is loamy fine sand to fine sand.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is high to very high for wind and slight for water.

The Sheppard soils are used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage on the hummocky soil is about 650 pounds per acre in favorable years and 325 pounds in unfavorable years. On the rolling soil it is about 575 pounds per acre in favorable years and 275 pounds in unfavorable years.

The Rock outcrop is mainly barren, exposed sandstone. Some smaller areas are shale. Both Sheppard soils in capability subclass VIIs; Sheppard fine sand, hummocky, in Sands range site, precipitation zone 1; Sheppard fine sand, rolling, in Choppy Sand range site, precipitation zone 1; Rock outcrop in capability class VIII.

SnB—Sogzie very fine sandy loam, 1 to 8 percent slopes. This soil is very deep and well drained. It is on broad mesa tops at elevations of 5,400 to 5,900 feet, on White Mesa in the eastern part of the survey area and on Piute Mesa on the west-central part. It formed in eolian material derived from sandstone.

The average annual precipitation is about 8 inches. The mean annual air temperature is about 52 degrees F, and the average frost-free season is about 140 days. Slopes are medium or long.

Included with this soil in mapping are small areas of Whit very fine sandy loam, 1 to 8 percent slopes, and Sheppard fine sand, high rainfall, hummocky.

In a typical profile the surface layer is reddish yellow very fine sandy loam about 5 inches thick. The subsoil is yellowish red very fine sandy loam about 16 inches thick. The upper 17 inches of the substratum is yellowish red very fine sandy loam. The lower part is light reddish brown fine sandy loam to a depth of 60 inches or more. The soil is moderately or strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is blue grama, black grama, galleta, Indian ricegrass, western wheatgrass, dropseed, globemallow, and fourwing saltbush. The potential annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 450 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, possible reseeding with crested wheatgrass or interseeding with Indian ricegrass or sand dropseed in selected areas, and possible chemical or mechanical control of undesirable species where needed. Capability subclass VIIe; Loamy range site, precipitation zone 2.

SoB—Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes. This soil is very deep and well drained. It is on Aneth Point, a broad terrace of the San Juan River, at elevations of 4,600 to 5,200 feet. It formed in eolian material derived mainly from sandstone.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are medium or long.

Included with this soil in mapping are small areas of Sheppard fine sand, hummocky, and other soils.

In a typical profile the surface layer is light brown very fine sandy loam about 5 inches thick. The subsoil is light brown very fine sandy loam about 15 inches thick. The substratum to a depth of 60 inches or more is light reddish brown fine sandy loam. The soil is strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is very low

in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, blue grama, galleta, fourwing saltbush, bud sagebrush, and shadscale. The potential annual yield of air-dry herbage is about 700 pounds per acre in favorable years and 350 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate a system of deferred-rotation grazing, and interseeding with Indian ricegrass or sand dropseed in carefully selected areas. Capability subclass VIIe; Loamy range site, precipitation zone 1.

SSD—Sogzie-Sheppard association, sloping. This map unit is on the broad, undulating top of Douglas Mesa in the west-central part of the survey area. Elevations are 5,600 to 6,000 feet. Sogzie very fine sandy loam, 1 to 8 percent slopes, makes up about 55 percent of the unit. It is in most parts of the area that have been subject to little recent wind deposition. Sheppard fine sand, high rainfall, hummocky, makes up about 25 percent. It is in those parts of the area that are exposed to wind deposition.

Included with this unit in mapping are small areas of Piute loamy fine sand, high rainfall, 3 to 25 percent slopes; Deleco fine sand, 2 to 12 percent slopes; and other sandy soils.

These soils formed in eolian deposits derived mainly from sandstone. The average annual precipitation is about 9 inches. The mean annual air temperature is about 52 degrees F, and the average frost-free season is about 140 days. Slopes are medium or long.

The Sogzie soil is very deep and well drained. In a typical profile the surface layer is reddish yellow very fine sandy loam about 5 inches thick. The subsoil is yellowish red very fine sandy loam about 16 inches thick. The upper 17 inches of the substratum is yellowish red very fine sandy loam. The lower part to a depth of 60 inches or more is light reddish brown fine sandy loam. The soil is moderately or strongly alkaline.

Permeability is moderate or moderately rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

The Sheppard soil is very deep and somewhat excessively drained. In a typical profile the surface layer is reddish yellow fine sand about 12 inches thick. The underlying material to a depth of 60 inches or more is reddish yellow loamy fine sand. The soil is mildly or moderately alkaline.

Permeability is rapid. The effective rooting depth is 60 inches or more, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is very high for wind and slight for water.

The Sogzie and Sheppard soils are used as range and wildlife habitat. The potential native vegetation on the Sogzie soil is blue grama, black grama, galleta, Indian ricegrass, western wheatgrass, dropseed, globemallow, and fourwing saltbush. The potential annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 450 pounds in unfavorable years.

Suggested range management practices on the Sogzie soil are fencing, rest-rotation grazing, possible reseeding with crested wheatgrass or interseeding with Indian ricegrass or sand dropseed in selected areas, and possible chemical or mechanical control of undesirable species where needed.

The potential native vegetation on the Sheppard soil is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage is about 750 pounds per acre in favorable years and 375 pounds in unfavorable years.

Suggested range management practices on the Sheppard soil are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass and sand dropseed in selected areas. Sogzie soil in capability subclass VIIe, Loamy range site, precipitation zone 2; Sheppard soils in capability subclass VIIs, Sands range site, precipitation zone 2.

TeA—Tezuma silt loam. This soil is very deep and well drained. It is on narrow valley bottoms of intermittent streams, along Montezuma Creek and its main tributaries in the northeastern part of the survey area. Elevations are 4,600 to 5,000 feet. This soil formed in mixed alluvium derived from sedimentary rock.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 160 days. Slopes are medium or long.

Included with this soil in mapping are small areas of Riverwash and Gullied land along the stream channels.

In a typical profile the surface layer is pale brown silt loam about 4 inches thick. Below this is about 14 inches of pale brown silt loam. The underlying material to a depth of 60 inches or more is pinkish gray silty clay. The soil is mainly strongly alkaline but is very strongly alkaline in the upper part in some profiles. It is commonly stratified.

Permeability is slow. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is low in the surface layer. Surface runoff is slow. The erosion hazard is slight.

This soil is used as range and wildlife habitat. The potential native vegetation is galleta, western wheatgrass, alkali sacaton, Indian ricegrass, inland saltgrass, black greasewood, and Nuttall saltbush. The potential annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 450 pounds in unfavorable years.

Suggested range management practices are fencing, winter utilization, deferred grazing or nonuse during the growing season, possible mechanical control of greasewood, and possible water spreading and seeding with alkali sacaton or tall wheatgrass in selected areas. Capability subclass VIs; Saline Lowland range site, precipitation zone 1.

TnC—Tohona sandy clay loam, 1 to 12 percent slopes. This soil is moderately deep and well drained. It is on undulating to rolling uplands and benches at elevations of 4,600 to 5,000 feet in several scattered areas north of the San Juan River in the northeastern part of the survey area. It formed in mixed alluvium and residuum derived from sedimentary rock.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are medium or long.

Included with this soil in mapping are small areas of Whit very fine sandy loam, low rainfall, 1 to 8 percent slopes; some shallow and very shallow soils; and Rock outcrop.

In a typical profile the surface layer is reddish yellow sandy clay loam about 5 inches thick. The upper 15 inches of the subsoil is reddish yellow sandy clay loam. The lower part is light reddish brown sandy clay loam that is about 10 percent gypsum. Weathered mudstone is at a depth of about 34 inches. The soil is moderately to very strongly alkaline. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderately slow. The effective rooting depth is 20 to 40 inches, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is galleta, western wheatgrass, alkali sacaton, Indian ricegrass, fourwing saltbush, shadscale, and Nuttall saltbush. The potential annual yield of air-dry herbage is about 300 pounds per acre in favorable years and 150 pounds in unfavorable years.

Suggested range management practices are fencing, winter utilization, and deferred grazing or nonuse during the growing season. Capability subclass VIIe; Saline Upland range site, precipitation zone 1.

ToB—Tohona variant, very fine sandy loam, 1 to 8 percent slopes. This soil is moderately deep and well drained. It is on undulating to rolling uplands at elevations of 4,800 to 5,400 feet in several small areas northeast of the San Juan River in the extreme eastern part of the survey area. It formed in residuum and eolian deposits.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 53 degrees F, and the average frost-free season is about 150 days. Slopes are short or medium.

Included with this soil in mapping are small areas of Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes; some shallow and very shallow soils; and Rock outcrop.

In a typical profile the surface layer is reddish brown very fine sandy loam about 6 inches thick. The subsoil is brown sandy clay loam about 12 inches thick. The substratum is brown sandy clay loam. Sandstone bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate. The effective rooting depth is 20 to 40 inches, and the available water capacity is moderately low. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, blue grama, galleta, fourwing saltbush, bud sagebrush, and shadscale. The potential annual yield of air-dry herbage is about 700 pounds per acre in favorable years and 350 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate a system of deferred-rotation grazing, and interseeding with Indian ricegrass or sand dropseed in carefully selected areas. Capability subclass VIIe; Loamy range site, precipitation zone 1.

TrD—Trail loamy sand, 1 to 8 percent slopes. This soil is very deep and well drained. It is on old river terraces at elevations of 3,800 to 4,400 feet on the south side of the San Juan River near Piute Farms in the northwestern part of the survey area. It formed in mixed alluvium derived from sedimentary rock.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 55 degrees F, and the average frost-free season is about 160 days. Slopes are long.

Included with this soil in mapping are small areas of Sheppard fine sand, rolling.

In a typical profile the surface layer is red loamy sand about 12 inches thick. Below this is about 25 inches of red loamy sand. The underlying material to a depth of 60 inches or more is reddish brown fine sandy loam. The soil is mildly or moderately alkaline. It is 5 to 15 percent gravel.

Permeability is rapid. Effective rooting depth is 60 inches or more, and the available water capacity is moderate. The organic matter content is very low in the surface layer. Surface runoff is slow. The erosion hazard is very high for wind and slight for water.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, galleta, sand dropseed, needleandthread, fourwing saltbush, Mormon-tea, and sand sagebrush. The potential annual yield of air-dry herbage is about 575 pounds per acre in favorable years and 275 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, and possible interseeding with Indian ricegrass or sand dropseed in selected areas. Capability subclass VIIs; Sands range site, precipitation zone 1.

UHG—Ustollic Haplargids-Ustic Torriorthents-Rock outcrop association, steep. This map unit is on steep to very steep side slopes of Navajo Mountain (fig. 10). Elevations are 6,000 to 8,500 feet. The Ustollic Haplargids and Ustic Torriorthents each make up about 30 percent of the unit, and Rock outcrop about 25 percent.

Included with this unit in mapping are small areas of shallow and very shallow soils.

The Ustollic Haplargids and Ustic Torriorthents formed in residuum and colluvium derived from sedimentary rock. The average annual precipitation is about 15 inches. The mean annual air temperature is about 43 degrees F, and the average frost-free season is about 100 days.

The Ustollic Haplargids and Ustic Torriorthents are moderately deep or deep and well drained. Texture is gravelly loam to very cobbly very fine sandy loam. The soils are underlain by unweathered bedrock at a depth of 20 to 60 inches. They are neutral. Slopes are 40 to 80 percent.

Permeability is moderately rapid or rapid. The available water capacity is moderately low. The organic matter content is moderate or low in the surface layer. Runoff is rapid. The erosion hazard is high.

The Rock outcrop consists of exposed sandstone and shale bedrock.

This unit is used as wildlife habitat and water supply. Capability subclass VIIe.

WhB—Whit very fine sandy loam, 1 to 8 percent slopes. This soil is very deep and well drained. It is on undulating mesa tops at elevations of 5,400 to 6,000 feet, on White Mesa in the southeastern part of the survey area and on McCracken Mesa and several other smaller mesas in the northeastern part. It formed in eolian deposits derived mainly from sandstone.

The average annual precipitation is about 9 inches. The mean annual air temperature is about 53 degrees F, and the average frost-free season is about 150 days. Slopes are long.

Included with this soil in mapping are small areas of Sogzie very fine sandy loam, Rock outcrop, and other soils.

In a typical profile the surface layer is yellowish red very fine sandy loam about 4 inches thick. The subsoil is yellowish red very fine sandy loam about 26 inches thick. The upper 13 inches of the substratum is light reddish brown very fine sandy loam. The lower part to a depth of 60 inches or more is pink very fine sandy loam and fine sandy loam. The soil is moderately to very strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is blue grama, black grama, galleta, Indian ricegrass, western wheatgrass, sand dropseed, globemallow, and fourwing saltbush. The potential annual yield of air-dry herbage is about 900 pounds per acre in favorable years and 450 pounds in unfavorable years.

Suggested range management practices are fencing, rest-rotation grazing, possible reseeding with crested wheatgrass or interseeding with Indian ricegrass or sand dropseed in selected areas, and possible chemical or mechanical control of undesirable species where needed. Capability subclass VIIe; Loamy range site, precipitation zone 2.

WkB—Whit very fine sandy loam, low rainfall, 1 to 8 percent slopes. This soil is very deep and well drained. It is on several undulating mesa tops south and east of McCracken Mesa in the northeastern part of the survey area. Elevations are 5,000 to 5,400 feet. This soil formed in eolian deposits derived mainly from sandstone.

The average annual precipitation is about 7 inches. The mean annual air temperature is about 54 degrees F, and the average frost-free season is about 160 days. Slopes are long.

Included with this soil in mapping are small areas of Tohona variant, very fine sandy loam, Rock outcrop, and other soils.

In a typical profile the surface layer is yellowish red very fine sandy loam about 4 inches thick. The subsoil is yellowish red very fine sandy loam about 26 inches thick. The upper 13 inches of the substratum is light reddish brown very fine sandy loam. The lower part to a depth of 60 inches or more is pink very fine sandy loam and fine sandy loam. The soil is moderately to very strongly alkaline.

Permeability is moderate. The effective rooting depth is 60 inches or more, and the available water capacity is moderately high. The organic matter content is very low in the surface layer. Surface runoff is medium. The erosion hazard is moderate.

This soil is used as range and wildlife habitat. The potential native vegetation is Indian ricegrass, blue grama, galleta, fourwing saltbush, big sagebrush, and shadscale. The potential annual yield of air-dry herbage is about 700 pounds per acre in favorable years and 350 pounds in unfavorable years.

Suggested range management practices are fencing, cross fencing to facilitate a system of deferred-rotation grazing, and interseeding with Indian ricegrass or sand dropseed in carefully selected areas. Capability subclass VIIc; Loamy range site, precipitation zone 1.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and manage-

ment. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for rangeland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Rangeland

Nearly all the farm income in the survey area is derived from livestock, chiefly sheep, goats, and cattle.

In most parts of the survey area the native vegetation has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with brush, weeds, and cactus. The amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by using management practices that are effective for specific kinds of soil and range sites.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

The map unit description shows, for each kind of soil, the name of the range site; the potential annual production of vegetation in favorable and unfavorable years; and

the names of the major species in the composition of the potential natural plant community.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Climate zones used with the range site names in this survey area reflect broad kinds of vegetation influenced mainly by difference in amount of precipitation, and to a lesser degree by elevation and temperature.

Zone 1 is mainly 5 to 8 inches of annual precipitation. These areas are generally at elevations of 5,500 feet or lower, and the general vegetation is semi-desert grasses, forbs, and shrubs.

Zone 2 is mainly 8 to 12 inches of annual precipitation. Elevation is 5,500 to 6,200 feet. The vegetation is generally mixed grasses, forbs, and shrubs.

Zone 3 is mainly 12 to 15 inches of annual precipitation. Elevation is 6,200 to 7,000 feet. The vegetation is sagebrush and grassland.

Zone 4 is mainly 15 to 17 inches of annual precipitation. Elevation is 6,500 to 7,500 feet. The vegetation is pinyon and juniper woodland.

Zone 6 is mainly 17 to 20 inches or more of annual precipitation. The vegetation is ponderosa pine and spruce forest.

Potential production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average, and in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major management concern on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community can be re-established. Controlling brush and minimizing soil blowing are also important. If sound range management based on the soil survey information and rangeland inventories is applied, the potential is good for increasing range productivity.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils

and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 5 shows, for each kind of soil, the degree and kind of limitations for building site development; table 6, for sanitary facilities; and table 8, for water management. Table 7 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 5. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, and open ditches. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 5 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 5 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of

these facilities will be of interest to contractors and local officials. Table 6 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 6 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 7 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 11 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 7 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 11.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 8 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 8 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable

material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 6, and interpretations for dwellings without basements and for local roads and streets, given in table 5.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluegrass, wheatgrass, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, aspen, serviceberry, and cliffrose. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine, spruce, fir, pinyon pine, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are mountain-mahogany, blackbrush, bitterbrush, snowberry, fourwing saltbush, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are alkali sacaton, saltgrass, rushes, and sedges.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include antelope, mule deer, sage grouse, meadowlark, and lark bunting.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all

soil series in the survey area, but laboratory data for some soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 11 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 11 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 11 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*, *5*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated AASHTO classification for soils tested in the survey area, without group index numbers, is given in table 11. Also in table 11 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 12 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste

disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 12. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 13 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 13 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Laboratory analysis of selected soils

The results of physical and chemical analysis of several typical pedons of the survey area are given in table 14. The data presented are for samples from soil series that are important in the survey area. All samples were collected from carefully selected sites that are typical of the series and discussed in the section "Soil series and morphology." The soil samples were analyzed by the Bureau of Indian Affairs, Water and Materials Testing Laboratory, Gallup, New Mexico.

All determinations were made on soil material smaller than 2 millimeters in diameter. All capacity measurements are reported on an oven-dry basis. Analyses for the percentages of sand, silt, and clay were made by pipette and sieve separations (*3*). Organic matter content was determined by the procedures of Peech and others (*4*). Additional methods that were used in obtaining the data are indicated in the list that follows. The codes, in parentheses, refer to published methods codes (*7*).

Water retained—pressure extraction, percentage of oven-dry weight of less than 2 millimeter material; 15 bars (4B2).

Reaction (pH)—1:1 water dilution (8C1a).

Electrical conductivity—saturation extract (8A1a).

Carbonate as calcium carbonate—manometric (6E1b).

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*8*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 15, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Aridisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthid (*Orth*, meaning true, plus *id*, from Aridisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Calciorthids (*Calci*, meaning calcium, plus *orthid*, the suborder of Aridisols that have a calcic horizon).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Calciorthids.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-loamy, mixed, mesic, Typic Calciorthids.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Anasazi series

The Anasazi series consists of moderately deep, well drained soils that formed in eolian deposits and in residuum from sandstone. Anasazi soils are on dissected pediments. Slopes are 3 to 25 percent. Elevations are 5,800 to 6,400 feet. The average annual precipitation is about 12 inches, and the mean annual temperature is about 48 degrees F.

Anasazi soils are near Begay and Shedado soils. Begay and Shedado soils do not have accumulated carbonate. Begay soils do not have bedrock within 40 inches.

Typical pedon of Anasazi very stony very fine sandy loam, 3 to 10 percent slopes, 1 mile northeast of Navajo Mountain School, SE1/4 sec. 22, T. 42 S., R. 10 E.

A1—0 to 4 inches; yellowish red (5YR 5/6) very stony very fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse platy structure in the surface inch, weak fine granular structure below; soft, very friable, nonsticky, nonplastic; few medium and fine roots; 15 percent fine gravel; about 15 percent of surface is covered by stones; slightly calcareous, lime is disseminated; moderately alkaline (pH 8.0); clear smooth boundary. (3 to 5 inches thick.)

B2—4 to 10 inches; red (2.5YR 5/6) heavy very fine sandy loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky, slightly plastic; few medium and fine roots; common fine and many very fine pores; 15 percent fine gravel; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.2); abrupt wavy boundary. (4 to 10 inches thick.)

C1ca—10 to 17 inches; pink (5YR 7/4) fine sandy loam, light reddish brown (5YR 6/4) moist; moderate medium platy structure; hard, slightly sticky, slightly plastic; few fine and very fine roots; few fine pores; very strongly calcareous; weakly to strongly cemented; strongly alkaline (pH 8.6); clear smooth boundary. (5 to 12 inches thick.)

C2ca—17 to 24 inches; pink (5YR 7/4) fine sandy loam, light reddish brown (5YR 6/4) moist; massive; slightly hard, firm, nonsticky, nonplastic; few very fine roots; common very fine pores; very strongly calcareous, weakly to strongly cemented; strongly alkaline (pH 8.6); abrupt wavy boundary. (5 to 12 inches thick.)

R—24 inches; sandstone bedrock.

The solum is 7 to 13 inches thick. The soil is 20 to 40 inches deep over sandstone.

The A1 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from very stony very fine sandy loam to loamy very fine sand that is 5 to 20 percent gravel. As much as 15 percent of the surface is covered by stone. This horizon is mildly or moderately alkaline.

The B2 horizon has hue of 2.5YR or 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from very fine sandy loam to fine sandy loam or to light sandy clay loam that is 10 to 20 percent gravel. It is mildly or moderately alkaline.

The Cca horizon has hue of 5YR or 2.5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 4 or 5. It ranges from fine sandy loam to very fine sandy loam and is moderately or strongly alkaline. The calcium carbonate equivalent in the Cca horizon ranges from 15 to 40 percent.

Aneth series

The Aneth series consists of deep and very deep, somewhat excessively drained soils that formed in eolian deposits derived mainly from sandstone. Aneth soils are on valley bottoms and terraces. Slopes are 0 to 8 percent. Elevations are 4,700 to 5,500 feet. The average annual precipitation is about 8 inches, and the mean annual temperature is about 57 degrees F.

Aneth soils are similar to Sheppard and Trail soils. They are near Sheppard, Begay, and Mota soils. Sheppard and Trail soils are loamy fine sand or coarser throughout the profile. Mota soils have a calcic horizon. Mota and Begay soils are very fine sandy loam in the 10- to 40-inch depth.

Typical pedon of Aneth loamy fine sand, 1 to 8 percent slopes, 6 miles south of White Mesa village, 200 feet north and 100 feet east of southwest corner sec. 16, T. 43 S., R. 24 E.

C1—0 to 7 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; weak thick platy structure that parts to single grain; soft, very friable, nonsticky, nonplastic; few fine roots; few fine discontinuous pores; slightly calcareous; moderately alkaline (pH 8.0); clear wavy boundary. (4 to 8 inches thick.)

C2—7 to 26 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable, nonsticky, slightly calcareous; strongly alkaline (pH 8.6); clear wavy boundary. (15 to 24 inches thick.)

C3ca—26 to 36 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; hard, friable, nonsticky, slightly plastic; few fine roots; common very fine discontinuous pores; moderately calcareous; strongly alkaline (pH 8.8); clear wavy boundary. (8 to 12 inches thick.)

C4—36 to 60 inches; reddish yellow (5YR 6/6) loamy fine sand, reddish brown (5YR 5/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few fine roots; common fine and very fine discontinuous pores; moderately calcareous; strongly alkaline (pH 8.6).

The soil is usually dry. It is not continually moist more than 25 percent of the time if the soil temperature is above 41 degrees F. The organic matter content decreases regularly with depth and is less than 0.35 percent at a depth of 50 inches.

The A1 horizon, where present, has hue of 5YR or 2.5YR, value of 4 through 6 dry and 3 through 5 moist, and chroma of 3 through 6. It is moderately or strongly alkaline and is 0 to 4 inches thick.

The C horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 3 through 8. To a depth of 40 inches it averages loamy fine sand bordering loamy very fine sand and contains strata of sandy loam, fine sandy loam, or very fine sandy loam. The C horizon is moderately or strongly alkaline and is slightly or moderately calcareous. The calcium carbonate equivalent in the Cca horizon is less than 15 percent.

Begay series

The Begay series consists of very deep, well drained soils that formed in eolian deposits derived mainly from sandstone. Begay soils are on rolling uplands and broad mesas. Slopes are 0 to 15 percent. Elevations are 5,500 to 6,000 feet. The average annual precipitation is about 12 inches, and the mean annual temperature is about 48 degrees F.

Begay soils are similar to Moepitz and Monue soils. They are near Aneth, Anasazi, Sogzie, and Moepitz soils. Moepitz and Monue soils are dry more than 75 percent of the time if the soil temperature is above 41 degrees F. Moepitz soils have bedrock at a depth of less than 40 inches. Anasazi and Sogzie soils have a calcic horizon. Anasazi soils have bedrock within 40 inches. Aneth soils are in the sandy family.

Typical pedon of Begay loamy fine sand, 3 to 8 percent slopes, 7 miles east and 5 miles north of Navajo Mountain School, SW1/4SE1/4 sec. 31, T. 42 S., R. 17 E.

A1—0 to 3 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; single grained; loose; slightly calcareous; lime is disseminated; moderately alkaline (pH 7.9); clear smooth boundary. (2 to 5 inches thick.)

B2—3 to 16 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; soft, friable, nonsticky, nonplastic; common fine roots; few fine pores; mildly alkaline (pH 7.8); clear wavy boundary. (11 to 17 inches thick.)

C1ca—16 to 28 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, firm, nonsticky, nonplastic; few fine roots; common fine pores; slightly hard, firm, nonsticky, nonplastic; few fine roots; common fine pores; slightly calcareous; lime is veined and disseminated; moderately alkaline (pH 7.9); gradual wavy boundary. (10 to 14 inches thick.)

C2ca—28 to 42 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, firm, nonsticky, nonplastic; moderately calcareous; moderately alkaline (pH 8.0); gradual wavy boundary. (12 to 16 inches thick.)

C3—42 to 60 inches; yellowish red (5YR 5/8) very fine sandy loam, yellowish red (5YR 4/8) moist; massive; soft, very friable, nonsticky, nonplastic; few fine pores; slightly calcareous; lime is disseminated; strongly alkaline (pH 8.1).

The regolith is more than 60 inches thick. In 6 years out of 10, the soil is dry in all parts of the moisture control section 50 to 75 percent of the time (cumulative) if the soil temperature at a depth of 20 inches is above 41 degrees F. The soil is moist in some parts of the moisture control section 30 to 40 days in summer and dry in some parts of the moisture control section 60 to 90 consecutive days in winter and early in spring.

The A1 horizon has hue of 5YR or 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from loamy fine sand to loamy very fine sand and is mildly or moderately alkaline.

The B2 horizon has hue of 5YR or 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from very fine sandy loam to loamy very fine sand and is mildly or moderately alkaline.

The C horizon has hue of 2.5YR or 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 6. It ranges from very fine sandy loam or fine sandy loam to loamy fine sand.

Carbonate content ranges from 0 to 3 percent in the A and B horizons and from 1 to 10 percent in the C horizon. The C horizon ranges from mildly to strongly alkaline.

Deleco series

The Deleco series consists of shallow, well drained soils that are 10 to 20 inches deep over a lime cemented hardpan. These soils formed in mixed alluvium and colluvium derived from sedimentary rock. Deleco soils are on terraces and fans. Slopes are 2 to 55 percent. Elevations are 4,400 to 6,400 feet. The average annual precipitation is about 8 inches, and the mean annual temperature is about 55 degrees F.

Deleco soils are near Aneth, Monue, Nakai, Neskahi, and Sheppard soils. None of these soils has a petrocalcic horizon or rock fragments in the 10- to 40-inch depth.

Typical pedon of Deleco loamy fine sand, 12 to 55 percent slopes, about 3 miles southeast of Bluff, 1,500 feet north and 1,000 feet east of the southwest corner sec. 33, T. 40 S., R. 22 E.

A1—0 to 3 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; weak thin platy structure; soft, friable, nonsticky, nonplastic; few medium and fine roots; few interstitial pores; 10 to 15 percent gravel; moderately calcareous; strongly alkaline (pH 8.6); clear wavy boundary. (2 to 5 inches thick.)

C1ca—3 to 7 inches; light reddish brown (5YR 6/4) gravelly sandy loam, reddish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky, slightly plastic; common fine and very fine roots; few interstitial pores; 25 percent angular gravel; very strongly calcareous; strongly alkaline (pH 8.8); clear wavy boundary. (2 to 5 inches thick.)

C2ca—7 to 10 inches; pinkish gray (7.5YR 6/2) very gravelly sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few fine roots; common fine interstitial pores; 70 percent angular gravel; very strongly calcareous with lime nodules and fragments; strongly alkaline (pH 9.0); abrupt wavy boundary. (2 to 10 inches thick.)

C3cam—10 to 14 inches; indurated lime cemented hardpan. (3 to 15 inches thick.)

C4ca—14 to 42 inches; pinkish white (5YR 8/2) sandy loam, pink (5YR 7/4) moist; massive; extremely hard, extremely firm; 5 percent gravel; strongly calcareous; lime is strongly cemented and massive; very strongly alkaline (pH 9.2); gradual wavy boundary. (24 to 32 inches thick.)

C5—42 to 45 inches; light reddish brown (5YR 6/4) sandy loam, yellowish red (5YR 5/6) moist; massive; hard, friable, nonsticky, slightly plastic; few interstitial pores; 15 percent gravel; strongly calcareous; strongly alkaline (pH 8.8).

Depth to lime cemented hardpan ranges from 7 to 20 inches. The mean annual soil temperature is 54 to 58 degrees F, and the mean summer soil temperature at a depth of 20 inches is 74 to 79 degrees. The soil is dry in all parts above the lime cemented hardpan 75 to 80 percent of the time if the soil temperature is above 41 degrees. The control section above the hardpan averages very gravelly sandy loam. It is 8 to 10 percent clay and 35 to 75 percent rock fragments. The weighted average organic matter content in the upper 15 inches is less than 1 percent.

The A1 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6.

The C horizon has hue of 5YR, 2.5YR, or 7.5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 2 through 6. Texture in individual strata ranges from gravelly fine sandy loam or very gravelly sandy loam to gravelly or very gravelly fine sand. The C horizon is moderately or very strongly alkaline.

Gotho series

The Gotho series consists of very deep, well drained soils that formed in mixed alluvium derived from sedimentary rock. Gotho soils are on narrow alluvial bottoms. Slopes are 0 to 8 percent. Elevations are 4,600 to 5,400 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 55 degrees F.

Gotho soils are near Aneth, Mota, and Sheppard soils. Sheppard soils are loamy fine sand or coarser in the 10- to 40-inch depth. Mota soils have a calcic horizon and are in the coarse-silty family. Aneth soils are dominantly loamy fine sand and have strata of fine sandy loam in the control section.

Typical pedon of Gotho clay, 0 to 3 percent slopes, about 2 1/2 miles west of Red Mesa pumping station, 2,600 feet north and 200 feet west of southeast corner sec. 25, T. 43 S., R. 22 E.

C1—0 to 4 inches; red (2.5YR 4/6) light clay, dark red (2.5YR 3/6) moist; weak medium granular structure; very hard, very firm, sticky, very plastic; few fine roots; many fine and very fine discontinuous pores; moderately calcareous; very strongly alkaline (pH 9.2); clear smooth boundary. (3 to 5 inches thick.)

C2—4 to 16 inches; yellowish red (5YR 4/6) light clay, yellowish red (5YR 4/8) moist; weak coarse prismatic structure that parts to moderate thick platy; very hard, very firm, very sticky, very plastic; few fine roots; many fine and very fine pores; moderately calcareous; strongly alkaline (pH 8.6); clear wavy boundary. (10 to 14 inches thick.)

C3—16 to 60 inches; yellowish red (5YR 4/6) sandy clay loam, yellowish red (5YR 4/8) moist; weak medium prismatic structure; hard, friable, sticky, plastic; common fine pores; moderately calcareous; strongly alkaline (pH 9.0).

The mean annual soil temperature is 54 to 58 degrees F, and the mean summer soil temperature at a depth of 20 inches is 74 to 79 degrees. The soil is dry 75 to 80 percent of the time (cumulative). It is not continually moist more than 25 percent of the time if the soil temperature is above 41 degrees. The organic matter decreases regularly with depth

and is less than 0.35 percent within a depth of 50 inches. The soil is slightly to moderately calcareous throughout.

The A1 horizon, where present, has hue of 5YR or 2.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 through 6. It is strongly or very strongly alkaline and is 0 to 6 inches thick.

The C horizon has hue of 2.5YR or 5YR, value of 4 through 6 dry and 4 or 5 moist, and chroma of 4 through 8. The 10- to 40-inch control section averages sandy clay loam that is about 19 to 30 percent clay. It is strongly or very strongly alkaline.

Hoskinnini series

The Hoskinnini series consists of shallow and very shallow, well drained soils that formed in residuum from sandstone and shale. Hoskinnini soils are on dissected pediments. Slopes are 1 to 12 percent. Elevations are 4,000 to 4,300 feet. The average annual precipitation is about 8 inches, and the mean annual temperature is about 55 degrees F.

Hoskinnini soils are near Trail and Moenkopie soils. Trail soils do not have bedrock within 60 inches. They are in the sandy family. Moenkopie soils do not have a calcic horizon or an argillic horizon.

Typical pedon of Hoskinnini gravelly fine sandy loam, 1 to 12 percent slopes, 5 miles west and 10 miles north of Oljeto Trading Post, NE1/4NE1/4 sec. 31, T. 41 S., R. 14 E.

A1—0 to 1 inch; light red (2.5YR 6/6) gravelly fine sandy loam, red (2.5YR 4/6) moist; coarse platy and vesicular structure; slightly hard, friable, nonsticky, nonplastic; surface pavement of fine iron stained caliche fragments; moderately calcareous; lime is disseminated with many caliche fragments; moderately alkaline (pH 8.2); clear smooth boundary. (1/2 inch to 2 inches thick.)

B21t—1 to 4 inches; red (2.5YR 4/6) gravelly heavy fine sandy loam, dark red (2.5YR 3/6) moist; weak medium subangular blocky structure that parts to medium fine granular; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; few fine pores; 25 percent gravel-size caliche fragments; moderately calcareous; lime is disseminated and in caliche fragments; moderately alkaline (pH 8.4); clear smooth boundary. (3 to 8 inches thick.)

B22t—4 to 8 inches; red (2.5YR 5/6) gravelly heavy fine sandy loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; few fine pores; 25 percent gravel-size caliche fragments; strongly alkaline (pH 8.6); clear smooth boundary. (2 to 5 inches thick.)

Cca—8 to 12 inches; pink (5YR 7/4) fine sandy loam, light reddish brown (5YR 6/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; very few fine roots; few fine pores; strongly calcareous; lime is in nodules; strongly alkaline (pH 8.6); abrupt wavy boundary. (3 to 5 inches thick.)

R—12 inches; sandstone bedrock.

The soil is 8 to 20 inches thick over bedrock. The mean annual soil temperature ranges from 54 to 59 degrees F. The mean summer soil temperature at the lithic contact ranges from 74 to 79 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time.

The A1 horizon has hue of 2.5YR or 5YR, value of 5 or 6 dry and 3 through 5 moist, and chroma of 5 or 6. It ranges from very fine sandy loam to gravelly fine sandy loam and is moderately or strongly alkaline.

The B2t horizon has hue of 2.5YR or 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 through 6. It is 5 to 13 inches thick.

The Cca horizon has hue of 5YR, value is 6 or 7 dry and 5 or 6 moist, and chroma of 4 through 6. It ranges from fine sandy loam or gravelly fine sandy loam to sandy loam and is moderately or strongly alkaline. The profile is as much as 30 percent gravel-size caliche fragments.

Mespun series

The Mespun series consists of deep and very deep, excessively drained soils that formed in eolian deposits derived mainly from sandstone. Mespun soils are on undulating broad mesa tops. Slopes are 0 to 10 percent. Elevations are 5,800 to 6,400 feet. The average annual precipitation is about 12 inches, and the mean annual temperature is about 47 degrees F.

Mespun soils are similar to Sheppard soils and are near Sogzie and Shedado soils. Sheppard and Sogzie soils are dry in the control section more than 75 percent of the time if the soil temperature is above 41 degrees F. Sogzie soils are in the coarse-silty family and have a calcic horizon. Shedado soils are in the coarse-loamy family.

Typical pedon of Mespun fine sand, 2 to 10 percent slopes, about 8 miles north and 2 miles east of Thumb Rock, NE1/4SW1/4 sec. 8, T. 42 S., R. 12 E.

A1—0 to 18 inches; yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6) moist; single grained; loose; common very fine roots; many fine interstitial pores; mildly alkaline (pH 7.4); gradual smooth boundary. (13 to 20 inches thick.)

C1—18 to 60 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; single grained; loose; common fine roots; many fine interstitial pores; mildly alkaline (pH 7.4).

The soil is 40 to more than 60 inches deep. The mean annual soil temperature at a depth of 20 inches ranges from 48 to 52 degrees F. The mean summer soil temperature at 20 inches ranges from 61 to 65 degrees. In 7 years out of 10, the soil is dry in all parts of the moisture control section 50 to 75 percent of the time (cumulative) if the soil temperature at 20 inches is above 41 degrees. The soil is moist in some parts of the moisture control section 30 to 40 days in summer. It is dry in some parts of the moisture control section 60 to 90 consecutive days in winter and early in spring.

The A horizon has hue of 5YR or 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It is fine sand or loamy fine sand.

The C horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. It is fine sand or loamy fine sand.

Moenkopie series

The Moenkopie series consists of very shallow to shallow, well drained soils that formed in residuum of weathered sandstone and shale. Moenkopie soils are in broad valleys and on undulating to hilly uplands. Slopes are 3 to 25 percent. Elevations are 4,600 to 5,500 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Moenkopie soils are similar to Pickrell soils and are near Aneth, Neskahi, and Raplee soils. Pickrell soils are in the sandy family and have a calcic horizon. Aneth and Neskahi soils do not have bedrock within 60 inches of the surface. Aneth soils are in the sandy family, and Neskahi soils are in the coarse-loamy family. Raplee soils have bedrock between 20 and 40 inches. They also have a gypsic horizon.

Typical pedon of Moenkopie sandy loam, 3 to 8 percent slopes, about 6 miles south and 2 miles west of Mexican Hat, SW1/4SW1/4 sec. 14, T. 43 S., R. 18 E.

A1—0 to 6 inches; red (2.5YR 5/6) sandy loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky; common very fine roots; few very fine pores; strongly calcareous; moderately alkaline (pH 8.1); surface pavement is 25 percent angular sandstone gravel; clear wavy boundary.

C—6 to 15 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky; few fine roots; few fine pores; 5 percent angular sandstone and shale fragments; strongly calcareous; moderately alkaline (pH 7.9); clear smooth boundary.

R—15 inches; fragmented shale and sandstone.

Depth to bedrock is 5 to 20 inches. The mean annual soil temperature ranges from 50 to 57 degrees F. The mean summer soil temperature at the lithic contact ranges from 72 to 76 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time.

The A horizon is sandy loam, loam, fine sandy loam, or loamy sand that is 2 to 10 percent fine angular gravel.

The C horizon is silt loam, fine sandy loam, sandy loam, or loam that is 5 to 10 percent angular shale fragments.

Moepitz series

The Moepitz series consists of moderately deep, well drained soils that formed in mixed alluvium and eolian deposits over residuum of weathered sandstone and shale. Moepitz soils are on rolling uplands. Slopes are 1 to 8 percent. Elevations are 4,500 to 5,200 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Moepitz soils are similar to Aneth, Begay, and Shedado soils. They are near Aneth, Begay, Deleco, and Nepalto soils. Aneth, Begay, and Nepalto soils are more than 60 inches deep to bedrock. Deleco soils have a petrocalcic horizon within 20 inches of the surface. Shedado soils have a moisture regime that is marginal to Ustic.

Typical pedon of Moepitz very fine sand, 3 to 8 percent slopes, 7 miles north of Navajo Mountain School, NW1/4NW1/4 sec. 27, T. 42 S., R. 10 E.

C1—0 to 10 inches; reddish yellow (5YR 6/8) very fine sand; yellowish red (5YR 5/8) moist; single grained; loose; few fine roots; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.2); gradual wavy boundary. (8 to 12 inches thick.)

C2—10 to 30 inches; reddish yellow (5YR 6/8) very fine sandy loam; yellowish red (5YR 5/8) moist; single grained; loose; few fine roots; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.4); abrupt wavy boundary. (16 to 28 inches thick.)

R—30 inches; sandstone bedrock.

The soil is 24 to 40 inches deep over bedrock. The mean annual soil temperature ranges from 54 to 58 degrees F. The mean summer soil temperature at a depth of 20 inches ranges from 74 to 79 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time. The organic matter content decreases regularly with depth.

The A1 horizon, where present, has hue of 5YR or 2.5YR, value of 4 to 6 dry and 3 through 5 moist, and chroma of 5 to 8. It ranges from moderately to strongly alkaline.

The C horizon has hue of 5YR or 2.5YR, value of 4 through 6 dry and 3 through 5 moist, and chroma of 5 through 8. It is dominantly very fine sandy loam but ranges from very fine sandy loam to fine sandy loam, loamy very fine sand, or very fine sand. This horizon is mildly or strongly alkaline.

Monue series

The Monue series consists of deep, well drained soils that formed in eolian deposits and alluvium derived from sandstone and shale. Monue soils are on valley bottoms and rolling uplands. Slopes are 1 to 8 percent. Elevations are 4,800 to 5,200 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Monue soils are similar to Begay and Nakai soils and are near Moepitz, Sheppard, Aneth, and Nepalto soils. Begay soils are moist more than one-fourth of the time if the soil temperature is above 41 degrees F. Nakai soils have a calcic horizon. Aneth, Sheppard, Moepitz, and Nepalto soils do not have a cambic horizon. Nepalto soils are gravelly loamy sand in the control section. Aneth soils average loamy fine sand in the 10- to 40-inch depth. Sheppard soils are loamy fine sand or coarser throughout the profile. Moepitz soils have bedrock within a depth of 40 inches.

Typical pedon of Monue loamy fine sand, 1 to 8 percent slopes, 2 miles east of Gouldings Trading Post, NW1/4NE1/4 sec. 32, T. 42 S., R. 16 E.

A1—0 to 13 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; very weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; few fine roots; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.4); clear wavy boundary. (10 to 15 inches thick.)

B2—13 to 24 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 6/4) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky, slightly plastic; few fine roots; common fine pores; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.8); abrupt wavy boundary. (10 to 14 inches thick.)

C1ca—24 to 35 inches; pink (5YR 7/4) very fine sandy loam, reddish brown (5YR 5/4) moist; strong thick platy structure that parts to moderate medium angular blocky; hard, firm, nonsticky, slightly plastic; few fine roots; common very fine pores; moderately calcareous; lime is disseminated and in small patches and veins; very strongly alkaline (pH 8.2); clear wavy boundary. (10 to 15 inches thick.)

C2—35 to 46 inches; yellowish red (5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; massive; hard, firm, nonsticky, nonplastic; moderately calcareous; lime is disseminated; strongly alkaline (pH 9.0); clear wavy boundary. (10 to 16 inches thick.)

R—46 to 50 inches; weathered shale and sandstone.

The depth to weathered shale and sandstone is 40 to 60 inches. The mean annual soil temperature ranges from 54 to 59 degrees F. The mean summer soil temperature at a depth of 20 inches ranges from 74 to 79 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time.

The A1 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from moderately to strongly alkaline.

The B2 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from very fine sandy loam to fine sandy loam and is moderately to strongly alkaline.

The C1ca horizon has hue of 5YR or 2.5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 4 or 5. The Cca horizon ranges from very fine sandy loam to fine sandy loam and is strongly or very strongly alkaline. The calcium carbonate equivalent in the Cca horizon is 3 to 10 percent.

Mota series

The Mota series consists of very deep, well drained soils that formed in eolian deposits derived mainly from sandstone. Gotho soils are on uplands, benches, and broad valleys. Slopes are 1 to 8 percent. Elevations are 4,600 to 5,400 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Mota soils are similar to Sogzie soils and are near Aneth, Sheppard, Gotho, and Moenkopie soils. Sogzie soils have a cambic horizon. They also have a calcic horizon, the upper boundary of which is between depths of 20 and 40 inches. Aneth, Sheppard, Gotho, and Moenkopie soils do not have a calcic horizon. Aneth and Sheppard soils average loamy fine sand or coarser in the control section. Gotho soils are in the fine-loamy family. Moenkopie soils have a lithic contact within 20 inches of the surface.

Typical pedon of Mota loamy very fine sand, 1 to 8 percent slopes, about 4 1/2 miles northwest of Red Mesa pumping station, 600 feet north and 600 feet west of southeast corner sec. 11, T. 43 S., R. 22 E.

A1—0 to 6 inches; yellowish red (5YR 5/6) loamy very fine sand, strong brown (7.5YR 5/6) moist; single grain; loose, soft, nonsticky, nonplastic; few medium and fine roots; many fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.6); clear wavy boundary. (4 to 10 inches thick.)

C1ca—6 to 23 inches; pinkish gray (7.5YR 7/2) very fine sandy loam, light brown (7.5YR 6/4) moist; moderate medium granular structure; hard, firm, sticky, slightly plastic; few fine roots; few very fine pores; very strongly calcareous; very strongly alkaline (pH 9.2); clear irregular boundary.

C2—23 to 60 inches; reddish yellow (5YR 6/6) loamy very fine sand, yellowish red (5YR 5/6) moist; massive; loose, soft, nonsticky, nonplastic; few very fine roots; common fine and very fine pores; moderately calcareous; strongly alkaline (pH 8.6).

The regolith is more than 60 inches thick. The mean annual soil temperature is 54 to 58 degrees F, and the mean summer soil temperature at a depth of 20 inches is 74 to 79 degrees. The texture of the control section averages very fine sandy loam that is about 12 to 15 percent clay and less than 15 percent coarser than very fine sand. The Mota soil is usually dry and has a zone of carbonate accumulation, the upper boundary of which is between depths of 6 and 15 inches. It is calcareous in all parts above the calcic horizon.

The A1 horizon has hue of 5YR, value of 6 and 7 dry and 4 through 6 moist, and chroma of 4 through 6.

The Cca horizon has hue of 5YR or 7.5YR, value of 5 through 8 dry and 4 through 6 moist, and chroma of 2 through 4. The C horizon below the Cca has hue of 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6.

Nakai series

The Nakai series consists of deep and very deep, well drained soils that formed in mixed alluvium and eolian deposits derived mainly from sandstone and shale. Nakai soils are on river terraces and fans and in broad valleys. Slopes are 1 to 8 percent. Elevations are 4,500 to 6,400 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Nakai soils are similar to Mota and Sogzie soils and are near Deleco, Neskahi, Whit, and Aneth soils. Mota and Sogzie soils are in the coarse-silty family. Deleco soils have a petrocalcic horizon within 20 inches of the surface and are gravelly in the control section. Neskahi, Whit, and Aneth soils do not have a calcic horizon.

Typical pedon of Nakai loamy fine sand, 1 to 8 percent slopes, about 2 miles southeast of Aneth community, 1,000 feet south and 300 feet west of northeast corner sec. 27, T. 41 S., R. 25 E.

A1—0 to 5 inches; reddish yellow (7.5YR 6/6) loamy fine sand, strong brown (7.5YR 5/6) moist; weak thick platy structure that parts to single grain; soft, very friable, nonsticky, nonplastic; few medium and fine roots; common medium and fine discontinuous pores; slightly calcareous; moderately alkaline (pH 8.4); clear wavy boundary. (4 to 6 inches thick.)

AC—5 to 18 inches; yellowish red (5YR 6/6) loamy fine sand, reddish yellow (5YR 5/6) moist; massive; soft, very friable, nonsticky, nonplastic; few fine roots; few medium and common fine and very fine pores; slightly calcareous; strongly alkaline (pH 8.6); clear wavy boundary. (10 to 15 inches thick.)

C1ca—18 to 26 inches; yellowish red (5YR 6/6) fine sandy loam, reddish yellow (5YR 5/6) moist; massive; slightly hard, very friable, nonsticky, slightly plastic; few fine roots; common fine and very fine pores; strongly calcareous; strongly alkaline (pH 8.8); clear wavy boundary. (5 to 10 inches thick.)

C2ca—26 to 34 inches; pinkish white (7.5YR 8/2) very fine sandy loam, pinkish gray (7.5YR 6/2) moist; massive; hard, friable, nonsticky, slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 9.0); clear wavy boundary. (6 to 10 inches thick.)

C3—34 to 60 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky, nonplastic; many fine interstitial pores; moderately calcareous; moderately alkaline. (pH 8.4).

The mean annual soil temperature is 54 to 58 degrees F, and the mean summer soil temperature at a depth of 20 inches is 74 to 79 degrees. The Nakai soil is dry in all parts above a depth of 24 inches 75 to 80 percent of the time if the soil temperature is above 41 degrees. It has a zone of carbonate accumulation, the upper boundary of which is between depths of 15 and 25 inches, and it is calcareous in all parts above the calcic horizon. The control section averages fine sandy loam. It is about 8 to 16 percent clay and more than 15 percent sand coarser than very fine sand. It is moderately or strongly alkaline.

The A1 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. The AC horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. It ranges from loamy fine sand to very fine sandy loam.

The Cca horizon has hue of 5YR or 7.5YR, value of 6 through 8 dry and 5 or 6 moist, and chroma of 2 through 4.

Namon series

The Namon series consists of deep or very deep, well drained soils that formed in residuum and colluvium derived from sandstone and shale. Namon soils are on mountain slopes and plateaus. Slopes are 3 to 55 percent. Elevations are 8,000 to 10,300 feet. The average annual precipitation is about 20 inches, and the mean annual temperature is about 40 degrees F.

Namon soils are most closely associated with Anasazi and Shedado soils. Anasazi and Shedado soils have a mean annual soil temperature of more than 47 degrees F and do not have rock fragments.

Typical pedon of Namon very cobbly very fine sandy loam, about 4 miles west of Navajo Mountain School, NW1/4NE1/4 sec. 26, T. 43 S., R. 9 E.

A1—0 to 5 inches; dark brown (7.5YR 4/2) very cobbly very fine sandy loam, very dark brown (7.5YR 2/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; few coarse and many medium and fine roots; common fine pores; 60 percent cobbles, gravel, and stones; neutral (pH 7.0); clear smooth boundary. (4 to 7 inches thick.)

A2—5 to 21 inches; light reddish brown (5YR 6/4) cobbly very fine sandy loam, reddish brown (5YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few coarse and many medium and fine roots; common fine pores; 40 percent cobbles, gravel, and stones; neutral (pH 7.2); clear wavy boundary. (12 to 20 inches thick.)

B1—21 to 33 inches; pink (5YR 7/4) very cobbly very fine sandy loam, reddish brown (5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky, slightly plastic; few coarse and common medium and fine roots; few fine pores; 60 percent cobbles, gravel, and stones; neutral (pH 7.2); clear wavy boundary. (10 to 14 inches thick.)

B2t—33 to 48 inches; light brown (7.5YR 6/4) very cobbly very fine sandy loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, very firm, slightly sticky, plastic; few coarse and common medium and fine roots; few very fine pores; common thin clay films on faces of peds and in pores; 70 percent cobbles, gravel, and stones; neutral (pH 7.2); abrupt smooth boundary. (14 to 30 inches thick.)

R—48 inches; sandstone.

The soil is 40 to 60 inches deep to bedrock. The upper boundary of the B2t horizon is between depths of 24 and 40 inches. Content of cobbles, gravel, and stones ranges from 35 to 80 percent throughout the profile. The mean annual soil temperature ranges from 41 to 45 degrees F. The mean summer soil temperature at 20 inches ranges from 54 to 59 degrees F.

The A1 horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 to 3. It ranges from very cobbly very fine sandy loam to very gravelly fine sandy loam. This horizon is 50 to 70 percent rock fragments ranging from fine gravel to boulders in size. It is neutral or slightly acid. The A2 horizon has hue of 5YR or 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 or 5. It ranges from cobbly very fine sandy loam to very cobbly sandy loam and is neutral or mildly alkaline.

The B1 horizon has hue of 5YR or 7.5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 4 or 5. It ranges from cobbly or very cobbly very fine sandy loam to very cobbly sandy loam and is neutral to mildly alkaline. The B2t horizon has hue of 5YR or 7.5YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 4 or 5. It ranges from very cobbly very fine sandy loam to very cobbly heavy sandy loam and is neutral or mildly alkaline.

Nepalto series

The Nepalto series consists of very deep, somewhat excessively drained soils that formed in mixed alluvium derived from sandstone and shale. Nepalto soils are on alluvial fans. Slopes are 2 to 8 percent. Elevations are 4,800 to 5,200 feet. The average annual precipitation is about 8 inches. The mean annual temperature is about 55 degrees F.

Nepalto soils are similar to Trail soils and are near Monue, Neskahi, and Pickrell soils. Trail soils are in the sandy family and are less than 35 percent cobbles and gravel. Monue soils have a cambic horizon. Neskahi soils average very fine sandy loam in the control section. Pickrell soils have a lithic contact within 20 inches of the surface.

Typical pedon of Nepalto very fine sandy loam, 2 to 8 percent slopes, 3 miles west and 2 miles north of Gouldings Trading Post, SW1/4SW1/4 sec. 15, T. 43 S., R. 15 E.

A1—0 to 12 inches; red (2.5YR 5/6) very fine sandy loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; weak thin platy structure in surface crust 1/4 to 1/2 inch thick; soft, very friable, nonsticky, nonplastic; few medium and fine roots; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.4); clear wavy boundary. (8 to 14 inches thick.)

C1—12 to 31 inches; red (2.5YR 5/6) gravelly loamy fine sand, reddish brown (2.5YR 4/6) moist; massive; slightly hard, firm, nonsticky, nonplastic; few fine roots; 35 percent gravel; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.6); clear wavy boundary. (15 to 22 inches thick.)

C2—31 to 60 inches; reddish brown (2.5YR 5/4) very gravelly sand, reddish brown (2.5YR 4/4) moist; single grain; loose, 60 percent gravel; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.8); clear wavy boundary.

The regolith is more than 60 inches thick. The mean annual soil temperature ranges from 54 to 59 degrees F. The mean summer soil temperature ranges from 74 to 79 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time. It is moderately or strongly alkaline.

The A1 horizon has hue of 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. It ranges from very fine sandy loam to loamy fine sand or stony very fine sandy loam.

The C horizon has hue of 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. It ranges from gravelly or very gravelly loamy fine sand to very gravelly sand. Gravel content ranges from 30 to 60 percent. Thin lime coatings are on the bottom sides of some rock fragments in some pedons.

Neskahi series

The Neskahi series consists of very deep, well drained soils that formed in mixed eolian deposits and alluvium derived mainly from sandstone. Neskahi soils occupy broad valley bottoms and outwash fans. Slopes are 1 to 8 percent. Elevations are 4,700 to 5,200 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Neskahi soils are similar to Redbank soils and are near Nepalto, Nakai, Deleco, and Oljeto soils. Redbank soils have a moisture regime that is marginal to Ustic. Nepalto soils average gravelly loamy sand in the control section. Oljeto and Nakai soils have a calcic horizon. Deleco soils have a petrocalcic horizon within a depth of 20 inches.

Typical pedon of Neskahi loamy fine sand, 1 to 8 percent slopes, 2 miles west of the Oljeto Trading Post, NE1/4NW1/4 sec. 22, T. 42 S., R. 14 E.

A1—0 to 6 inches; reddish yellow (5YR 6/8) loamy fine sand, yellowish red (5YR 4/8) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, nonplastic; common fine and medium roots; common fine pores; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 8 inches thick.)

C1—6 to 16 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; soft, friable, nonsticky, nonplastic; many fine and few medium roots; few fine pores; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.6); clear smooth boundary. (8 to 12 inches thick.)

C2—16 to 25 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; moderate coarse subangular blocky structure; hard, firm, slightly sticky, slightly plastic; few fine roots;

few coarse and many fine pores; common cicada krotovina; moderately calcareous; lime is in veins and nodules; strongly alkaline (pH 8.8); clear wavy boundary. (7 to 11 inches thick.)

C3—25 to 35 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; moderate coarse subangular blocky structure; hard, firm, nonsticky, slightly plastic; few fine roots; many fine pores; common cicada krotovina; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.8); clear wavy boundary. (8 to 12 inches thick.)

C4—35 to 60 inches; yellowish red (5YR 5/6) fine sandy loam; yellowish red (5YR 4/6) moist; moderate coarse subangular blocky structure; soft, friable, nonsticky, slightly plastic; few fine roots; common fine pores; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.6).

The regolith is more than 60 inches thick. The mean annual soil temperature ranges from 54 to 59 degrees F. The mean summer soil temperature at a depth of 20 inches ranges from 74 to 79 degrees. The texture of the control section averages very fine sandy loam. It is less than 18 percent clay. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time.

The A1 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 through 8. It is loamy fine sand or very fine sandy loam and is moderately or strongly alkaline.

The C horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. It ranges from fine sandy loam to loam and is moderately or strongly alkaline.

Oljeto series

The Oljeto series consists of very deep, somewhat excessively drained soils that formed in mixed alluvium derived from sandstone and shale. Oljeto soils are on alluvial fans and terraces. Slopes are 1 to 8 percent. Elevations are 4,800 to 5,300 feet. The average annual precipitation is about 8 inches, and the mean annual temperature is about 54 degrees F.

Oljeto soils are similar to Nepalto soils and are near Neskahi, Sheppard, and Nepalto soils. Nepalto, Neskahi, and Sheppard soils do not have a calcic horizon. Neskahi soils average fine sand in the control section.

Typical pedon of Oljeto loamy fine sand, 1 to 8 percent slopes, 2 miles southwest of Oljeto Trading Post, SW1/4SW1/4 sec. 26, T. 42 S., R. 14 E.

A1—0 to 20 inches; red (2.5YR 5/6) loamy fine sand; red (2.5YR 4/8) moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few medium and common fine pores; 5 percent fine gravel; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.2); clear wavy boundary. (16 to 24 inches thick.)

C1ca—20 to 40 inches; light red (2.5YR 6/6) very gravelly loamy coarse sand, red (2.5YR 4/8) moist; single grained; loose; few medium and fine roots; few fine pores; 60 percent fine gravel; strongly calcareous; lime is disseminated and in thin coatings on bottom sides of rock fragments; moderately alkaline (pH 8.4); gradual wavy boundary. (16 to 24 inches thick.)

C2—40 to 60 inches; red (2.5YR 5/6) very gravelly loamy sand, red (2.5YR 4/8) moist; single grained; loose; few medium and fine roots; few fine pores; 70 percent fine gravel; moderately calcareous; lime is disseminated; moderately alkaline (pH 8.4).

The regolith is more than 60 inches thick. The mean annual soil temperature ranges from 54 to 59 degrees F. The mean summer soil temperature at a depth of 20 inches ranges from 74 to 79 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time.

The A1 horizon has hue of 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 6 through 8 moist. It is mildly or moderately alkaline. Gravel content ranges from 0 to 10 percent in this horizon.

The Cca horizon has hue of 2.5YR or 5YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 6 through 8 moist. It ranges from very gravelly loamy coarse sand to very gravelly sand and is moderately or strongly alkaline. The C horizon has hue of 2.5YR or 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 6 through 8 moist. It ranges from very gravelly loamy sand to very gravelly sand and is moderately or strongly alkaline. Gravel content is 50 to 70 percent in the Cca and C horizons.

Pickrell series

The Pickrell series consists of shallow, well drained soils that formed in eolian deposits and residuum of weathered sandstone. Pickrell soils are on mesas and benches. Slopes are 1 to 8 percent. Elevations are 4,800 to 5,500 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Pickrell soils are similar to Moenkopie, Oljeto, and Piute soils and are near Nepalto and Neskahi soils. Oljeto soils are in the sandy-skeletal family and do not have bedrock within a depth of 60 inches. Piute and Moenkopie soils do not have a calcic horizon. Nepalto and Neskahi soils do not have bedrock within 60 inches, and they do not have a calcic horizon.

Typical pedon of Pickrell loamy fine sand, 1 to 8 percent slopes, 1 mile north and 3 miles west of Oljeto Trading Post, SW1/4SW1/4 sec. 35, T. 42 S., R. 14 E.

A11—0 to 2 inches; yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6) moist; single grained; loose; few fine roots; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.6); clear smooth boundary. (0 to 3 inches thick.)

A12—2 to 5 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; soft, friable, nonsticky, nonplastic; common fine roots; few fine and very fine pores; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.6); clear smooth boundary. (2 to 6 inches thick.)

B2—5 to 12 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few medium and common fine roots; few fine pores; moderately calcareous; lime is disseminated; strongly alkaline (pH 8.6); clear wavy boundary. (5 to 12 inches thick.)

C1ca—12 to 18 inches; pink (5YR 7/4) gravelly loamy fine sand, reddish yellow (5YR 6/6) moist; massive; very hard, very firm, nonsticky, nonplastic; few fine pores; 30 percent lime nodules; strongly calcareous; lime is nodular; weakly or strongly cemented; strongly alkaline (pH 8.8); abrupt wavy boundary. (5 to 8 inches thick.)

R—18 inches; sandstone bedrock.

The soil is 12 to 20 inches deep over bedrock. The mean annual soil temperature ranges from 54 to 59 degrees F. The mean summer soil temperature at the lithic contact ranges from 74 to 79 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time.

The A1 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from loamy fine sand to fine sand and is moderately to strongly alkaline.

The B2 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from loamy fine sand to fine sand and is moderately to strongly alkaline.

The Cca horizon has hue of 5YR or 2.5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 4 through 6. It is strongly to very strongly alkaline.

Piute series

The Piute series consists of very shallow, well drained soils that formed in eolian deposits and residuum of weathered sandstone. Piute soils are on rolling uplands. Slopes are 3 to 25 percent. Elevations are 4,600 to 6,500 feet. The average annual precipitation is about 8 inches, and the mean annual temperature is about 52 degrees F.

Piute soils are near Aneth and Moepitz soils. Aneth soils do not have a lithic contact within 60 inches of the surface. Moepitz soils have a lithic contact between depths of 24 and 40 inches, and the texture averages loamy very fine sand in the control section.

Typical pedon of Piute loamy fine sand, 3 to 25 percent slopes, 9 miles northeast of Navajo Mountain School, SW1/4SW1/4 sec. 22, T. 42 S., R. 11 E.

C1—0 to 9 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; massive; soft, friable, nonsticky, nonplastic; few medium and fine roots; few fine pores; moderately alkaline (pH 8.0); abrupt wavy boundary. (7 to 10 inches thick.)

R—9 inches; sandstone bedrock.

The soil is 7 to 10 inches deep over sandstone. The mean annual soil temperature ranges from 52 to 56 degrees F. The mean summer soil temperature at the lithic contact ranges from 72 to 76 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time.

The C horizon has hue of 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from loamy fine sand to fine sand and is mildly to moderately alkaline.

Raplee series

The Raplee series consists of moderately deep, well drained soils that formed in materials derived from gypsiferous sandstone and shale. Raplee soils are on dissected pediments and have slopes of 1 to 12 percent. Elevations are 4,700 to 5,200 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Raplee soils are similar to Moepitz and Tohona soils and are near Aneth and Neskahi soils. Moepitz, Aneth, and Neskahi soils do not have the high gypsum content, and Aneth and Neskahi soils do not have bedrock within 60 inches of the surface. Tohona soils are in the fine-silty family and have a cambic horizon.

Typical pedon of Raplee very fine sandy loam, 1 to 12 percent slopes, 7 miles west and 9 miles south of Mexican Hat, NE1/4 of the NW1/4 sec. 25, T. 43 S., R. 17 E.

C1—0 to 4 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 4/6) moist; surface 1/2 inch has weak thin platy structure, massive below; soft, very friable, nonsticky, slightly plastic; few medium and fine roots; strongly gypsiferous; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.8); clear wavy boundary. (3 to 6 inches thick.)

C2—4 to 22 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 4/6) moist; massive; soft, very friable, nonsticky, slightly plastic; few fine and medium roots; strongly gypsiferous; moderately calcareous; lime is disseminated; mildly alkaline (pH 7.8); abrupt wavy boundary. (17 to 24 inches thick.)

C3—22 to 36 inches; interbedded fractured sandstone and soft shale; common fine roots between rock fragments.

R—36 inches; consolidated sandstone bedrock.

The regolith is 20 to 30 inches thick above the paralithic contact and 30 to 40 inches above the consolidated bedrock. The mean annual soil temperature ranges from 54 to 59 degrees F. The mean summer soil temperature at a depth of 20 inches ranges from 74 to 79 degrees. The soil is dry in all parts above the base of the moisture control section 75 to 85 percent of the time. Gypsum content is estimated to range from 30 to 60 percent.

The C horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 5 or 6. It ranges from loam to very fine sandy loam and is mildly or moderately alkaline.

Redbank series

The Redbank series consists of very deep, well drained soils that formed in eolian deposits and alluvium. Redbank soils are on broad mesa tops. Slopes are 2 to 12 percent. Elevations are 6,000 to 6,500 feet. The average annual precipitation is about 12 inches, and the mean annual temperature is about 47 degrees F.

Redbank soils are similar to Begay soils and are near Shedado soils. Begay soils have a cambic horizon. Shedado soils have a regular decrease in organic matter content with depth and have bedrock at a depth of 20 to 40 inches.

Typical pedon of Redbank very fine sandy loam, 2 to 12 percent slopes, 10 miles east of Navajo Mountain School, NE1/4SW1/4 sec. 29, T. 43 S., R. 12 E.

A1—0 to 8 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak thick platy structure; soft, friable, nonsticky, nonplastic; common fine and very fine roots; few fine pores; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.2); gradual wavy boundary. (7 to 10 inches thick.)

C1—8 to 28 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 4/6) moist; moderate medium and coarse subangular blocky structure; soft, friable, nonsticky, nonplastic; common fine and very fine roots; common fine pores; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.4); gradual wavy boundary. (17 to 24 inches thick.)

C2—28 to 42 inches; reddish yellow (5YR 6/8) loamy fine sand, yellowish red (5YR 4/8) moist; moderate medium and coarse subangular blocky structure; slightly hard, firm, nonsticky, nonplastic; few fine roots; slightly calcareous; lime is disseminated; moderately alkaline (pH 8.4); gradual wavy boundary. (13 to 16 inches thick.)

IIC3—42 to 60 inches; pink (5YR 7/3) fine sandy loam, light reddish brown (5YR 6/4) moist; massive; extremely hard, very firm, slightly sticky, slightly plastic; very few fine roots; very strongly calcareous; lime is weakly to strongly cemented; strongly alkaline (pH 9.0).

The regolith is more than 60 inches thick. The mean annual soil temperature ranges from 48 to 52 degrees F. The mean summer soil temperature at a depth of 20 inches ranges from 61 to 65 degrees. In 7 years out of 10, the soil is dry in all parts of the moisture control section 60 to 75 percent of the time (cumulative) if the soil temperature at 20 inches is above 41 degrees. It is moist in some parts of the moisture control section 30 to 40 days in summer and dry in some parts of the moisture control section 60 to 90 days in winter and early in spring.

The A1 horizon has hue of 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 or 5.

It ranges from very fine sandy loam to loamy very fine sand and is mildly to moderately alkaline.

The C horizon has hue of 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 6 through 8. It is moderately to strongly alkaline. The IIC horizon has hue of 5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 3 or 4. Texture ranges from fine sandy loam to very fine sandy loam. Reaction is strongly to very strongly alkaline.

Shedado series

The Shedado series consists of moderately deep, well drained soils that formed in eolian deposits and materials weathered from sandstone. Shedado soils are on broad mesas and rolling uplands. Slopes are 1 to 12 percent. Elevations are 6,000 to 6,400 feet. The average annual precipitation is about 12 inches, and the mean annual temperature is about 48 degrees F.

Shedado soils are similar to Moepitz soils and are near Anasazi and Begay soils. Moepitz soils are dry more than 75 percent of the time if the soil temperature is above 41 degrees F. Anasazi soils have a calcic horizon, and Begay soils have a cambic horizon. Anasazi and Begay soils do not have bedrock within a depth of 60 inches.

Typical pedon of Shedado loamy very fine sand, 1 to 8 percent slopes, 1 1/2 miles east of Navajo Mountain School, NW1/4SE1/4 sec. 26, T. 43 S., R. 10 E.

A1—0 to 7 inches; yellowish red (5YR 5/6) loamy very fine sand, yellowish red (5YR 4/6) moist; weak medium granular structure; soft, very friable, nonsticky, nonplastic; few fine and very fine roots; few fine and very fine pores; neutral (pH 7.0); clear wavy boundary. (5 to 8 inches thick.)

C1—7 to 15 inches; yellowish red (5YR 5/8) very fine sand, yellowish red (5YR 4/8) moist; single grained; loose; few medium and fine roots; few medium pores; many fine interstitial pores; neutral (pH 7.0); gradual wavy boundary. (5 to 9 inches thick.)

C2—15 to 24 inches; reddish brown (5YR 5/4) loamy very fine sand, reddish brown (5YR 4/4) moist; massive; slightly hard, friable, nonsticky, nonplastic; few medium, fine, and very fine roots; few fine and very fine pores; neutral (pH 7.2); gradual wavy boundary. (6 to 10 inches thick.)

C3—24 to 35 inches; yellowish red (5YR 5/6) loamy very fine sand, yellowish red (5YR 4/6) moist; massive; slightly hard, friable, nonsticky, nonplastic; neutral (pH 7.2); abrupt wavy boundary. (8 to 13 inches thick.)

R—35 inches; sandstone bedrock.

The soil is 24 to 40 inches deep over sandstone. The mean annual soil temperature ranges from 48 to 52 degrees F. The mean summer soil temperature at a depth of 20 inches ranges from 61 to 65 degrees. The texture of the control section averages loamy very fine sand but includes individual strata of loamy fine sand and very fine sand. In 7 years out of 10, the soil is dry in all parts of the moisture control section 50 to 75 percent of the time if the soil temperature at 20 inches is above 41 degrees. It is moist in some part of the moisture control section 30 to 40 days in summer and dry in some parts of the moisture control section 60 to 90 days in winter and early in spring.

The A1 horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. It ranges from loamy very fine sand to very fine sandy loam.

The C horizon has hue of 5YR or 2.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6. It is neutral to mildly alkaline.

Sheppard series

The Sheppard series consists of deep or very deep, somewhat excessively drained soils that formed in eolian deposits derived mainly from sandstone. Sheppard soils are on dune land. Slopes are 3 to 12 percent. Elevations are 4,400 to 6,000 feet. The average annual precipitation is about 9 inches, and the mean annual temperature is about 53 degrees F.

Sheppard soils are similar to Aneth soils and are near Aneth, Deleco, and Mota soils. Aneth soils have strata of very fine sandy loam in the control section. Deleco soils have a petrocalcic horizon. Mota soils are very fine sandy loam or loamy very fine sand in the control section and have a calcic horizon.

Typical pedon of Sheppard fine sand, hummocky, about 3 miles south and 2 miles east of White Mesa Village, 1,500 feet north and 600 feet west of southeast corner sec. 27, T. 41 S., R. 22 E.

C1—0 to 12 inches; reddish yellow (5YR 6/6) fine sand, yellowish red (5YR 5/6) moist; very weak thick platy structure in top 2 inches that parts to single grain; soft, loose; few fine roots; many fine interstitial pores; slightly calcareous; moderately alkaline (pH 8.4); gradual wavy boundary. (9 to 16 inches thick.)

C2—12 to 60 inches; reddish yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; single grain; soft, loose; few medium and fine roots; few coarse pores; many fine interstitial pores; slightly calcareous; moderately alkaline (pH 8.4).

The soil is more than 60 inches deep. The mean annual soil temperature is 54 to 58 degrees F, and the mean summer soil temperature is 72 to 79 degrees. The control section averages loamy fine sand, loamy sand, fine sand, or sand. Hue ranges from 2.5YR through 7.5YR, but is dominantly 5YR, value is 5 or 6 dry and 4 or 5 moist, and chroma ranges from 4 through 6. Reaction is mildly or moderately alkaline.

Sogzie series

The Sogzie series consists of very deep, well drained soils that formed in eolian deposits derived from sandstone. Sogzie soils are on broad mesa tops. Slopes are 1 to 8 percent. Elevations are 4,600 to 5,900 feet. The average annual precipitation is about 8 inches, and the mean annual temperature is about 54 degrees F.

Sogzie soils are similar to Mota and Whit soils and are near Aneth and Whit soils. Mota soils have a calcic horizon, the upper boundary of which is between depths of 6 and 15 inches. They do not have a cambic horizon. Whit soils are more than 18 percent clay in the control section. Aneth soils have a very fine sand and very fine sandy loam control section and do not have a calcic horizon.

Typical pedon of Sogzie very fine sandy loam, 1 to 8 percent slopes, about 3 miles south of White Mesa Village, 500 feet north and 2,000 feet east of southwest corner sec. 33, T. 42 S., R. 24 E.

A1—0 to 5 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; weak thick platy structure; soft, very friable, nonsticky, nonplastic; few fine roots; few fine pores; slightly calcareous; strongly alkaline (pH 8.6); clear wavy boundary. (3 to 8 inches thick.)

B21—5 to 12 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few medium and fine roots; common fine and very fine pores; slightly calcareous; strongly alkaline (pH 8.6); gradual wavy boundary. (5 to 9 inches thick.)

B22—12 to 21 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak medium prismatic structure that parts to weak medium angular blocky; slightly hard, very friable, nonsticky, slightly plastic; few fine roots; few fine and very fine pores; moderately calcareous; strongly alkaline (pH 8.6); gradual wavy boundary. (7 to 11 inches thick.)

C1—21 to 38 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure that parts to weak medium subangular blocky; hard, friable, nonsticky, slightly plastic; few fine roots; few medium and common fine and very fine pores; moderately calcareous; moderately alkaline (pH 8.4); clear irregular boundary. (16 to 24 inches thick.)

C2ca—38 to 80 inches; light reddish brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) moist; weak medium subangular blocky structure; very hard, firm, slightly sticky, plastic; few fine roots; common fine and very fine pores; moderately calcareous; moderately alkaline (pH 8.4); clear irregular boundary. (30 to 45 inches thick.)

C3—80 to 96 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; massive; very hard, very firm, slightly sticky, plastic; few fine and very fine pores; strongly calcareous; strongly alkaline (pH 9.0).

The mean annual soil temperature is 54 to 58 degrees F, and the mean summer soil temperature at a depth of 20 inches is 74 to 79 degrees. The Sogzie soil is usually dry in all parts above 24 inches 75 to 80 percent of the time if the soil temperature is above 41 degrees. It has a calcic horizon, the upper boundary of which is between depths of 20 to 40 inches, and it is calcareous in all parts above the calcic horizon. The 10- to 40-inch control section averages very fine sandy loam that is about 11 to 14 percent clay and less than 15 percent sand coarser than very fine sand. It is moderately or strongly alkaline.

The A1 horizon has hue of 5YR or 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 4 through 6.

The Cca horizon has hue of 5YR or 7.5YR, value of 5 through 8 dry and 4 through 6 moist, and chroma of 3 through 6.

Tezuma series

The Tezuma series consists of very deep, well drained soils that formed in mixed alluvium derived from sedimentary rock. Tezuma soils are on narrow valley bottoms along intermittent streams. Slopes are 0 to 3 percent. Elevations are 4,500 to 5,000 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 55 degrees F.

Tezuma soils are nearly always surrounded by Badland. They are most closely associated with Tohona and Whit soils. Tohona soils have a gypsic horizon, and the texture of the control section averages sandy clay loam. Whit soils have a calcic horizon, and the texture of the control section averages very fine sandy loam.

Typical pedon of Tezuma silt loam, about 1/4 mile north of Hatch Trading Post, 2,000 feet north and 1,000 feet west of southeast corner sec. 13, T. 38 S., R. 25 E.

A1—0 to 4 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate thin platy structure that parts to fine granular; hard, firm, sticky, plastic; few medium and few fine roots; vesicular pores in top 1/2 inch crust; many fine and very fine pores below 1/2 inch; moderately calcareous; very strongly alkaline (pH 9.8); clear wavy boundary. (2 to 5 inches thick.)

C1—4 to 18 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak thin platy structure that parts to weak fine granular; slightly hard, very friable, slightly sticky, plastic; few fine roots; common fine and very fine pores; moderately calcareous; strongly alkaline (pH 9.0); clear wavy boundary. (12 to 16 inches thick.)

C2—18 to 60 inches; pinkish gray (7.5YR 6/2) silty clay, brown (7.5YR 4/2) moist; massive; very hard, very firm, sticky, very plastic; few fine roots; common fine and very fine pores; moderately calcareous; strongly alkaline (pH 8.5).

The regolith is more than 60 inches thick to bedrock. The soil is dry more than 50 percent of the time if the soil temperature is above 41 degrees F. Texture in the control section is dominantly silty clay. It averages more than 35 percent clay but has strata of silt loam. The mean annual soil temperature is 54 to 58 degrees, and the mean summer soil temperature at 20 inches is 74 to 79 degrees. The organic matter content decreases irregularly with depth.

The A1 horizon has hue of 10YR, value of 5 or 6 dry, and 4 or 5 moist, and chroma of 2 and 3. It is strongly to very strongly alkaline.

The C horizon has hue of 10YR and 7.5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 and 3. It is moderately to strongly alkaline.

Tohona series

The Tohona series consists of moderately deep, well drained soils that formed in mixed alluvium and residuum derived from sedimentary rock. Tohona soils are on undulating to rolling uplands and benches. Slopes are 1 to 12 percent. Elevations are 4,600 to 5,000 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 54 degrees F.

Tohona soils are similar to Raplee soils and are near Whit soils. Raplee soils are in the coarse-loamy family and do not have a cambic horizon. Whit soils do not have a gypsic horizon and do not have bedrock within 60 inches of the surface. They have a calcic horizon.

Typical pedon of Tohona sandy clay loam, 1 to 12 percent slopes, about 5 miles north of Aneth Community, 1,200 feet south of N1/4 corner sec. 28, T. 40 S., R. 25 E.

A1—0 to 5 inches; reddish yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 6/6) moist; moderate thick platy structure that parts to very fine granular; hard, friable, sticky, plastic; few fine roots; vesicular pores in the top inch, common fine and very fine pores below; moderately calcareous; moderately alkaline (pH 8.4); clear wavy boundary. (3 to 7 inches thick.)

B21—5 to 20 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak medium and coarse prismatic structure that parts to weak medium subangular blocky; very hard, very firm, very sticky, very plastic; few fine roots; common fine and very fine pores; moderately calcareous; moderately alkaline (pH 8.4); clear wavy boundary. (13 to 23 inches thick.)

B22cs—20 to 34 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic structure that parts to moderate medium subangular blocky; very hard, very firm, very sticky, very plastic; few fine and very fine roots; few very fine pores; common gypsum veins and pockets; moderately calcareous; strongly alkaline (pH 8.6); gradual wavy boundary. (12 to 18 inches thick.)

Cr—34 to 52 inches; weathered mudstone.

Depth to weathered bedrock is 20 to 40 inches. The mean annual soil temperature is 54 to 59 degrees F, and the mean summer soil temperature at a depth of 20 inches is 74 to 79 degrees. The Tohona soil is dry in all parts above a depth of 12 inches 75 to 80 percent of the time if the soil temperature is above 41 degrees. It has a gypsic horizon, the upper boundary of which is between 18 and 30 inches. The gypsum content is 9 to 15 percent. The soil is calcareous in all parts above the gypsic horizon. The control section averages sandy clay loam that is 30 to 34 percent clay and less than 15 percent coarser than very fine sand. The soil is moderately to very strongly alkaline.

The A1 horizon has value of 6 or 7 dry and 5 or 6 moist and chroma of 4 through 6.

Tohona variant

The Tohona variant consists of moderately deep, well drained soils that formed in mixed residuum and eolian deposits derived from sedimentary rock. Tohona variant soils are on undulating to rolling uplands. Slopes are 1 to 8 percent. Elevations are 4,800 to 5,400 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 53 degrees F.

Tohona variant soils are similar to Tohona, Sogzie, and Whit soils and are near Nakai soils. Tohona soils have a gypsic horizon and a cambic horizon and do not have a calcic horizon. Tohona, Whit, and Nakai soils do not have bedrock within 60 inches of the surface. Sogzie soils are in the coarse-silty family, and Nakai soils are in the coarse-loamy family.

Typical pedon of Tohona variant, very fine sandy loam, 1 to 8 percent slopes, about 5 miles southeast of Aneth Community, 1,300 feet north and 2,500 feet west of southeast corner sec. 36, T. 41 S., R. 25 E.

A1—0 to 6 inches; reddish brown (5YR 5/4) very fine sandy loam, (5YR 4/4) moist; weak thick platy structure that parts to weak fine subangular blocky; soft, very friable, nonsticky, slightly plastic; few fine roots; common fine and very fine pores; moderately calcareous; strongly alkaline (pH 8.9); clear wavy boundary. (4 to 7 inches thick.)

B2—6 to 18 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, plastic; few fine roots; common fine and very fine pores; moderately calcareous; strongly alkaline (pH 9.0); gradual wavy boundary. (10 to 14 inches thick.)

C1ca—18 to 34 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/4) moist; hard, firm, slightly sticky, plastic; few fine roots; common fine and very fine pores; strongly calcareous; moderately alkaline (pH 8.3); abrupt wavy boundary. (13 to 20 inches thick.)

R—34 inches; sandstone bedrock.

The solum is 14 to 21 inches thick. The A1 horizon ranges from reddish brown to yellowish brown. The B2 horizon ranges from brown to reddish brown. The Cca horizon ranges from brown to pink very fine sandy loam to sandy clay loam. Sandstone bedrock is at a depth of 20 to 40 inches.

Trail series

The Trail series consists of very deep, well drained soils that formed in mixed alluvium. Trail soils are on old river terraces. Slopes are 1 to 8 percent. Elevations are 3,800 to 4,400 feet. The average annual precipitation is about 7 inches, and the mean annual temperature is about 55 degrees F.

Trail soils are near Hoskinnini soils. Hoskinnini soils have bedrock within 20 inches of the surface, are in the loamy family, and have an argillic horizon.

Typical pedon of Trail loamy sand, 1 to 8 percent slopes, about 1 1/2 miles northeast of Piute Farms, NW1/4NE1/4 sec. 1, T. 41 S., R. 14 E.

C1—0 to 12 inches; red (2.5YR 5/6) loamy sand, red (2.5YR 4/6) moist; weak medium subangular blocky structure; soft, very friable, nonsticky; few fine roots; few fine pores; moderately calcareous; 5 percent gravel; moderately alkaline (pH 8.3); diffuse boundary. (8 to 14 inches thick.)

C2—12 to 25 inches; red (2.5YR 5/6) loamy sand, red (2.5YR 4/6) moist; weak medium subangular blocky structure; soft, very friable, nonsticky; few fine roots; few fine pores; moderately calcareous; 5 percent gravel; moderately alkaline (pH 8.2); diffuse boundary. (10 to 15 inches thick.)

C3—25 to 37 inches; red (2.5YR 5/6) loamy sand, red (2.5YR 4/6) moist; weak medium subangular blocky structure; soft, very friable, nonsticky; few fine roots; few fine pores; moderately calcareous; 5 percent gravel; moderately alkaline (pH 7.9); gradual wavy boundary.

C4—37 to 60 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; massive; slightly hard, firm, nonsticky; very few fine and very fine roots; many fine and very fine pores; moderately calcareous; 10 to 15 percent gravel; moderately alkaline (pH 8.2).

The soil is more than 60 inches deep. The mean annual soil temperature at a depth of 20 inches ranges from 53 to 57 degrees F, and the mean summer soil temperature ranges from 74 to 79 degrees. Texture of individual strata ranges from fine sandy loam to sand or loamy sand but averages loamy sand. Gravel content ranges from 5 to 15 percent.

Whit series

The Whit series consists of very deep, well drained soils that formed in eolian deposits derived mainly from sandstone. Whit soils are on undulating to rolling mesa tops. Slopes are 1 to 8 percent. Elevations are 5,000 to 6,000 feet. The average annual precipitation is about 8 inches, and the mean annual temperature is about 54 degrees F.

Whit soils are similar to Sogzie soils and are near Gotho and Tohona soils. Sogzie soils are in the coarse-silty family. Gotho soils do not have a calcic horizon. Tohona soils have a gypsic horizon and do not have a calcic horizon.

Typical pedon of Whit very fine sandy loam, 1 to 8 percent slopes, about 3 1/2 miles southeast of White Mesa Village, 2,500 feet north and 300 feet west of southeast corner sec. 35, T. 43 S., R. 24 E.

A1—0 to 4 inches; yellowish red (5YR 5/6) very fine sandy loam, reddish brown (5YR 4/4) moist; weak thick platy structure that parts to weak very fine granular; soft, very friable, nonsticky, slightly plastic; few medium and fine roots; common fine and very fine pores; slightly calcareous; strongly alkaline (pH 8.8); gradual wavy boundary. (3 to 7 inches thick.)

B21—4 to 16 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure that parts to weak medium subangular blocky; slightly hard, very friable, nonsticky, slightly plastic; few fine roots; common medium pores; moderately calcareous; strongly alkaline (pH 8.6); gradual wavy boundary. (10 to 14 inches thick.)

B22—16 to 30 inches; reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; few coarse and common fine pores; moderately calcareous; moderately alkaline (pH 8.4); gradual wavy boundary. (12 to 16 inches thick.)

C1ca—30 to 43 inches; light reddish brown (5YR 6/4) very fine sandy loam, reddish brown (5YR 5/4) moist; massive; hard, friable, nonsticky, slightly plastic; few fine roots; few coarse and common very fine pores; strongly calcareous; moderately alkaline (pH 8.4); gradual wavy boundary. (10 to 15 inches thick.)

C2ca—43 to 54 inches; pink (5YR 7/4) very fine sandy loam, reddish yellow (7.5YR 6/6) moist; massive; hard, friable, nonsticky, slightly plastic; few fine pores; very strongly calcareous; very strongly alkaline (pH 9.2); abrupt wavy boundary. (10 to 14 inches thick.)

C3ca—54 to 66 inches; pink (7.5YR 8/4) fine sandy loam, reddish yellow (7.5YR 6/6) moist; massive; very hard, friable, nonsticky, slightly plastic; few fine pores; very strongly calcareous; very strongly alkaline (pH 9.2); abrupt wavy boundary.
R—66 inches; sandstone bedrock.

The mean annual soil temperature is 52 to 58 degrees F, and the mean summer soil temperature at a depth of 20 inches is 72 to 78 degrees. The Whit soil is dry throughout the upper 12 inches 75 to 80 percent of the time if the soil temperature is above 41 degrees. It has a calcic horizon, the upper boundary of which is between depths of 20 and 40 inches. It is calcareous in all parts above the calcic horizon. The control section averages very fine sandy loam. It is dominantly 18 to 25 percent clay and less than 15 percent sand coarser than very fine sand. It is moderately to very strongly alkaline.

The A horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 4 through 6. It is moderately or strongly alkaline.

The B horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 4 through 6. The Cca horizon has hue of 5YR or 7.5YR, value of 6 through 8 dry and 5 through 7 moist, and chroma of 3 through 6.

Formation of the soils

The pages that follow define the factors of soil formation, relate them to the formation of soils in the survey area, and explain the processes of soil formation.

The characteristics of a soil at any given point are determined by the interaction of five principal factors: (1) the parent material, (2) the climate under which the soil material has accumulated and has existed since accumulation, (3) the relief, or topography, which influences the local or internal environment of the soil and its drainage, moisture content, aeration, susceptibility to erosion, and exposure to the sun and wind, (4) the biological forces, or the plants and animals living on or in the soil that have acted upon the soil material, and (5) the length of time the climatic and biological forces have acted upon the soil material.

The soils in the Navajo Indian Reservation survey area show the interaction of all five factors of soil formation.

Parent material

Soils on the mesa tops and benches and some soils in the broad valleys and rolling uplands formed in eolian deposits. This wind blown material was derived mainly from fine-grained sandstone. It was deposited in the Navajo area; most of it had been transported only a relatively short distance, generally less than 50 miles. This parent material ranges in texture from very fine sandy loam to fine sand. Sheppard, Mespun, and Piute soils formed in the coarse textured material consisting mostly of fine sand and loamy fine sand. Piute soils formed partially in residuum from sandstone. Aneth and Pickrell soils formed in the moderately coarse to coarse textured material. Aneth soils are influenced by alluvium, and Pickrell soils by residuum from sandstone. Anasazi, Begay, Monue, Moepitz, and Shedado soils formed in the loamy material. Mota, Sogzie, and Whit soils and the Tohona variant formed in the silty material.

Soils on the fans, narrow valley bottoms, and terraces, and some soils in the broad valleys and rolling uplands formed in mixed alluvium. This parent material was derived mainly from sandstone, shale, mudstone, and limestone. It was deposited by local intermittent streams. Deleco, Oljeto, and Nepalto soils formed in the gravelly sediment on fans and terraces. Trail soils formed in the sandy sediment on river terraces. Nakai, Neskahi, and Redbank soils formed in the coarse-loamy sediment on broad valley bottoms and terraces. In some areas those soils are influenced by eolian deposits. Gotho soils formed in stratified sediment but are mainly loamy and are on narrow valley bottoms. Tohona soils formed in silty sediment on uplands. Tezuma soils formed in fine sediment on narrow valley bottoms.

Soils on the dissected pediments and some soils on the mesa tops and uplands formed in residuum from sandstone, shale, and mudstone. This parent material has mostly weathered in place from the parent rocks but is influenced in places by eolian and alluvial deposits. All of the soils formed in this parent material are very shallow, shallow, or moderately deep. Piute and Pickrell soils formed in the sandy residuum. Shedado, Raplee, Hoskinnini, and Moenkopie soils formed in the loamy material and the Tohona variant in the silty material.

Soils on the mountainsides formed in colluvium and residuum from sandstone and shale. On the slopes of Navajo Mountain this parent material is gravelly and cobbly. It is material that has weathered in place or that has been moved mostly by gravity only a relatively short distance down the mountainsides. Namon soils formed in this parent material.

Climate

The climate in the Navajo area ranges from arid to dry subhumid continental. Winters are cold, and summers are warm. The average annual precipitation ranges from 6 to 20 inches.

In general, both the climate and the elevation contribute to soil formation. The amount of precipitation increases with increasing elevation. On the valley floors, benches, uplands, terraces, and lower mesa tops at elevations of about 4,200 to 5,400 feet, the average annual precipitation is generally between 6 and 9 inches and the mean annual air temperature is 54 to 60 degrees F.

Some high mesa tops and dissected pediments at elevations of 5,600 to 6,400 feet generally have 10 to 14 inches of precipitation annually and have a mean annual air temperature of 46 to 53 degrees F.

On the slopes of Navajo Mountain at elevations of 7,600 to 10,300 feet, the mean annual precipitation is 16 to 20 inches and the mean annual air temperature is 38 to 44 degrees F.

The influence of climate is noticeable mainly in the accumulation of organic matter in the surface layer and in the transformation of minerals and clays in forming distinct horizons. Following or accompanying the leaching

of carbonates some silicate clay is translocated or formed in place by alteration of minerals. Through this process a B2t horizon forms.

The Namon soil is the only identified series in the higher precipitation zone, 16 to 20 inches. This soil developed a thin, dark colored A1 horizon and a thick, light colored A2 horizon from which the soluble minerals have been leached and much of the silicate clay translocated.

In the intermediate precipitation zone, 10 to 14 inches, the Mespun, Shedado, and Redbank soils have not been in place long enough to have developed distinct horizons other than an accumulation of organic matter. Anasazi and Begay soils have developed a distinct horizon of carbonate accumulation.

In the lower precipitation zone, 6 to 10 inches, the Hoskinnini soils have developed an argillic horizon, the Deleco soils a strongly cemented lime horizon, and the Tohona soils a gypsic horizon. The Mota, Nakai, Oljeto, Pickrell, Sogzie, and Whit soils and the Tohona variant have developed strong accumulations of carbonates.

Relief

Relief, or landform, influences soil formation principally in its effect on runoff, drainage, erosion, deposition, and exposure to wind. The dominant landforms or topographic features in the Navajo area are (1) valley floors, uplands, low terraces, and pediments; (2) mesa tops, high terraces, and benches; (3) steep canyon walls, mesa sides, and lower mountainsides; and (4) mountain slopes.

Valley floors, uplands, low terraces, and pediments are generally subject to deposition of alluvial and eolian material. In places these areas are also subject to severe water and wind erosion so that deposits accumulate only in protected areas. Aneth, Sheppard, and Neskahi soils are examples of the soils on these landforms.

Mesa tops, high terraces, and benches are likely positions for accumulations of eolian material. Wind velocities ordinarily slacken over these areas.

The steep canyon walls, mesa sides, and lower mountainsides are subject to severe water and wind erosion. There is little opportunity for soil material to accumulate. Exposed bedrock is common. Because of the wide variation of soils in these areas, only subgroups were mapped: Lithic Torriorthents, Typic Torriorthents, Ustollic Haplargids, and Ustic Torriorthents.

On the slopes of Navajo Mountain, colluvium and residuum have accumulated and remained in place long enough to form a well developed soil. Namon soils are on the slopes of Navajo Mountain.

Plants and animals

Plants strongly influence the kind, amount, and position of organic matter in the soil. Living organisms influence soil structure and porosity and thus influence the rate of air and water movement through the soil. Plants and animals mix the soil and may retard horizon formation. The decay of forest litter results in the formation of acids. These acids, in solution, hasten the leaching processes, and bases are leached rapidly from the soil.

The following main plant zones occur in the Navajo Indian Reservation survey area—

Dry grass-shrub zone.—The dominant vegetation in this zone is Indian ricegrass, galleta, blue grama, needleandthread, sand dropseed, shadscale, Mormon-tea, and fourwing saltbush. Big sagebrush is common at the higher elevations. Because rainfall is low and soil temperature in summer is high, very little organic matter has accumulated in the soils. Aneth, Moenkopie, Sheppard, and Sogzie soils are representative in this plant zone.

Pinyon-juniper zone.—In this zone the tree species are pinyon pine and Utah juniper. The main understory plants are big sagebrush, Mormon-tea, Indian ricegrass, galleta, and blue grama. The soils in this zone contain slightly more organic matter in the surface layer than in the drier zone. Representative in this zone are the Anasazi, Mespun, and Shedado soils and the Ustollic Haplargids and Ustic Torriorthents.

Mountain shrub, browse, and conifer zone.—The tree species in this zone are ponderosa pine and scattered patches of spruce, fir, and aspen in protected pockets at the higher elevations. The understory and plants in nontimbered areas are big sagebrush, snowberry, bluegrass, needlegrass, and sedge. Namon is the only soil mapped in this zone. It has a dark colored A1 horizon that is about 3 percent organic matter and a thick, bleached A2 horizon.

Time

Soil formation requires time. It can require centuries or only a few years. The distinctness of a soil horizon depends in part on the length of time the processes of soil formation have been acting.

Among the soils of the Navajo Indian Reservation survey area, the young soils on alluvial bottoms and in areas subject to recent wind deposition have the lowest degree of horizonation. Sheppard, Aneth, and Tezuma soils are representative of these young soils that have developed only a weak A1 horizon.

Many soils formed on uplands, benches, terraces, and mesa tops have had carbonates leached from the surface horizon and redeposited to form a moderate to strong calcic horizon. Representative of these soils are the Nakai, Sogzie, and Whit. The Tohona soil has developed a gypsic horizon, and the Deleco soil an indurated, lime-cemented hardpan. The Namon soil on Navajo Mountain has accumulated a dark colored A1 horizon, and soluble salts and carbonates have been leached from the profile. Clay has been translocated to form a B2t horizon.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2
Low	2 to 3.75
Moderately low	3.75 to 5
Moderate	5 to 7.5
Moderately high	7.5 to 10
High	More than 10

Badland. Steep or very steep, commonly nonstony barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Erosion pavement. A layer of gravel or stones that remains on the ground surface after fine particles are removed by wind or water. Desert pavements result from erosion in arid areas.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May,* for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinc-

tion between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. Hydrous calcium sulphate.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Landslide. The rapid downhill movement of a mass of soil and loose rock generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pediment. A gently sloping rock surface at the foot of a steep slope.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its use and management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects use and management.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Pitting. Formation of pits as a result of the melting of ground ice after the removal of plant cover.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Poorly graded. Refers to a coarse-grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent*, *good*, *fair*, and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that weathers from disintegrating bedrock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan that can be excavated using a single tooth ripping attachment mounted on a tractor with a 200 to 300 draw-bar horsepower rating (D8 or equivalent).

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediments onto the lowland as a series of adjacent alluvial fans.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a coarse-grained soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Illustrations

Figure 1.—Anasazi very stony very fine sandy loam, 3 to 10 percent slopes. The vegetation is dominantly blackbrush, Mormon-tea, juniper, and pinyon pine. Navajo Mountain is in the background.

Figure 2.—Aneth loamy fine sand, 1 to 8 percent slopes. The vegetation is dominantly big sagebrush and scattered juniper.

Figure 3.—Hoskinnini-Rock outcrop complex, 2 to 8 percent slopes, in foreground. Monitor Mesa is in the background.

Figure 4.—Moepitz very fine sand, 3 to 8 percent slopes. The vegetation is dominantly blackbrush, Mormon-tea, and horsebrush.

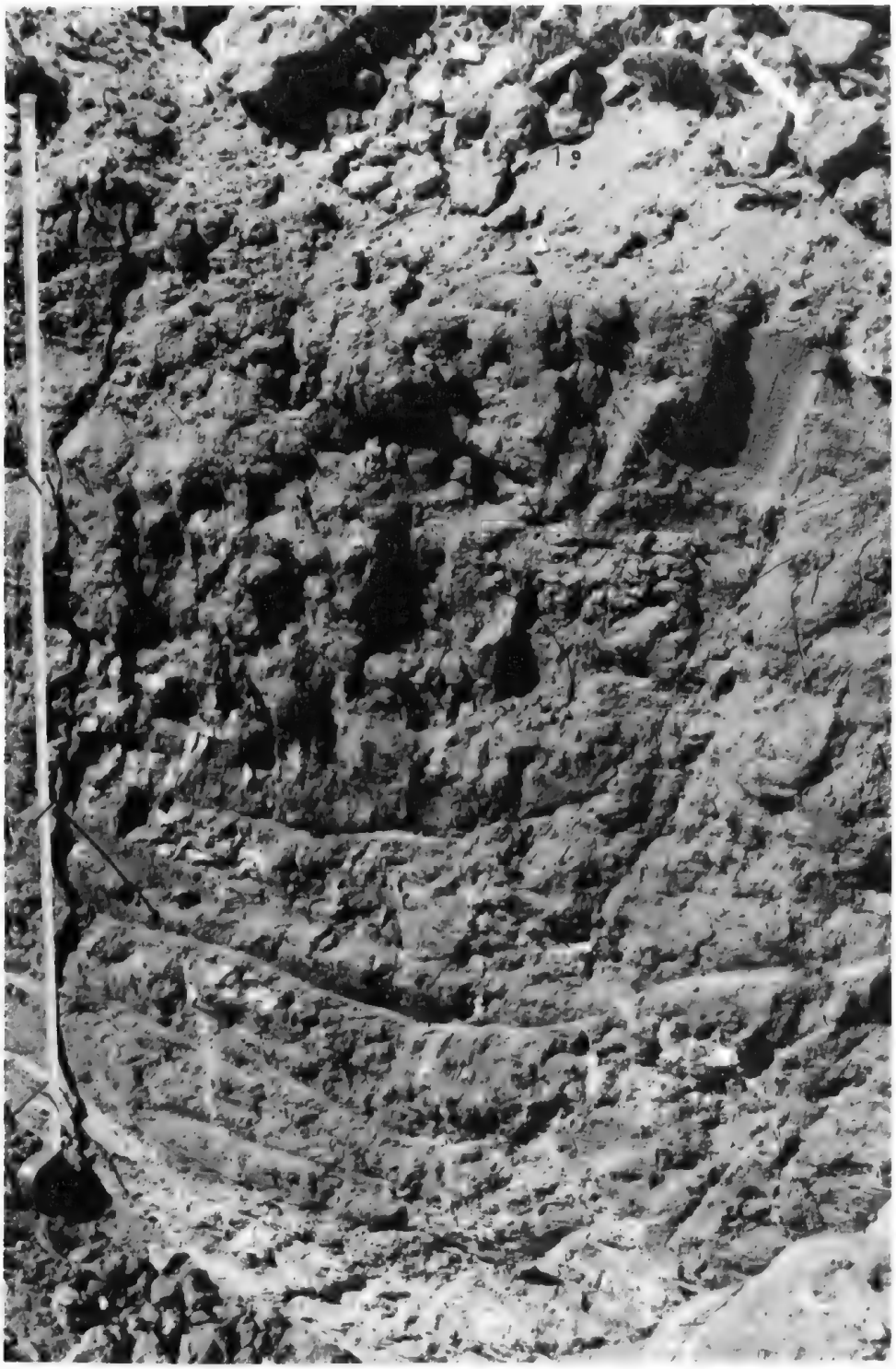

Figure 5.—Profile of Moepitz very fine sand, 3 to 8 percent slopes, showing slight veins of carbonates. Bedrock is at a depth of 36 inches.

Figure 6.—Neskahi loamy fine sand in an area of Neskahi-Oljeto association, sloping. The vegetation is dominantly alkali sacaton and Mormon-tea. Rock outcrop is in the background.

Figure 7.—Piute-Rock outcrop complex, 3 to 25 percent slopes. The vegetation is dominantly juniper, blackbrush, galleta, and Mormon-tea.

Figure 8.—Smoother, more nearly level area in Rock outcrop, sandstone-Lithic Torriorthents association, steep.

Figure 9.—Hoskinnini very fine sandy loam, very shallow, 2 to 5 percent slopes. Rock outcrop-Moenkopie association, steep, is in the background.

Figure 10.—Navajo Mountain in background. The mountaintop is Namon-Rock outcrop complex, 3 to 25 percent slopes. Below this is Namon-Rock outcrop complex, low rainfall, 25 to 55 percent slopes. The very steep slope below is Ustollic Haplargids-Ustic Torriorthents-Rock outcrop association, steep. Anasazi very stony very fine sandy loam is in the foreground.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Station: Aneth Latitude: 37° 18'

Elevation: 4650 Longitude: 109° 18' Period Record: 1959-70

Month	Temperature				Precipitation			
			2 years in 10 will have at least 4 days with--			1 year in 10 will have		
	Average daily maximum	Average daily minimum	Maximum temperature equal to or higher than	Minimum temperature equal to or higher than	Average monthly total	Less than	More than	Average snow fall
	F	F	F	F	In	In	In	In
January----	39.2	16.1	54	0	.58	0	3.40	1.1
February---	51.9	28.2	62	16	.60	0	1.45	.2
March------	60.6	31.9	76	22	.44	0	2.77	.5
April------	69.4	38.0	79	29	.24	0	1.46	T[1/]
May--------	81.5	49.0	92	38	.38	0	1.06	T[1/]
June-------	90.7	57.7	103	49	.17	.0	1.17	0
July-------	96.1	65.8	105	58	.83	.08	1.48	0
August-----	94.1	62.9	105	54	.92	.0	1.50	0
September--	83.1	55.7	94	44	1.29	.0	4.37	0
October----	71.1	42.5	83	32	1.12	.0	5.47	0
November---	56.7	31.4	67	21	.77	.11	1.72	0
December---	40.9	20.9	55	2	.73	.18	2.66	3.6
Annual-----	69.6	41.7			8.07			5.4

[1/] Trace

TABLE 2.--TEMPERATURE AND PRECIPITATION DATA

Station: Mexican Hat Latitude: 37° 09'

Elevation: 4200 Longitude: 109° 52' Period Record: 1952-76

Month	Temperature				Precipitation			
			2 years in 10 will have at least 4 days with--			1 year in 10 will have		
	Average daily maximum	Average daily minimum	Maximum temperature equal to or higher than	Minimum temperature equal to or higher than	Average monthly total	Less than	More than	Average snow fall
	F	F	F	F	In	In	In	In
January----	43.8	18.2	57	1	.40	0	1.45	1.7
February---	53.2	24.7	65	15	.40	.01	.86	.2
March------	61.6	30.6	76	20	.36	0	.74	0
April------	71.9	38.9	83	29	.30	.03	.74	0
May--------	82.3	48.9	93	37	.27	T[1]	.63	0
June-------	92.8	57.8	103	49	.28	0	1.08	0
July-------	98.6	66.1	105	57	.67	.10	1.71	0
August-----	95.3	63.9	103	54	.82	.13	1.42	0
September--	87.8	53.6	95	42	.52	0	1.15	0
October----	74.5	41.1	86	30	.93	0	1.82	0
November---	57.8	29.1	71	21	.47	.02	.87	.4
December---	45.9	20.6	55	4	.53	T[1]	1.13	1.0
Annual----	72.1	41.1			5.95			3.3

[1] Trace

TABLE 3.--TEMPERATURE AND PRECIPITATION DATA

Station: Navajo Mountain Latitude: 37° 01'

Elevation: 6020 Longitude: 110° 48' Period Record: 1961-76

Month	Temperature				Precipitation			
			2 years in 10 will have at least 4 days with--			1 year in 10 will have		
	Average daily maximum	Average daily minimum	Maximum temperature equal to or higher than	Minimum temperature equal to or higher than	Average monthly total	Less than	More than	Average snow fall
	F	F	F	F	In	In	In	In
January----	39.6	13.5	53	-4	.86	.05	1.89	5.7
February---	46.9	20.3	53	9	.98	0	2.08	7.7
March------	52.3	24.5	66	14	.76	0	1.81	7.3
April------	61.5	31.7	71	21	.44	0	1.06	2.0
May--------	71.8	42.0	84	30	.31	0	1.15	.6
June-------	83.4	49.8	95	30	.35	0	1.11	0
July-------	89.5	58.4	97	49	.26	0	.65	0
August-----	86.0	55.1	96	49	.84	0	2.10	0
September--	77.4	46.2	87	37	.95	0	2.60	T[1]
October----	66.2	35.1	80	23	1.53	0	4.35	1.1
November---	53.5	27.1	66	15	1.00	.23	1.17	2.2
December---	41.7	16.2	54	3	1.06	T[1]	2.70	4.8
Annual----	64.2	35.0			9.34			31.4

[1] Trace

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AaC	Anasazi very stony very fine sandy loam, 3 to 10 percent slopes	5,400	0.4
AaF	Anasazi very stony very fine sandy loam, 10 to 25 percent slopes	2,700	0.2
AmB	Aneth loamy fine sand, 1 to 8 percent slopes	70,580	5.3
AnA	Aneth loamy fine sand, moderately alkali, 0 to 3 percent slopes	6,100	0.5
AsA	Aneth sandy clay loam, 0 to 3 percent slopes	4,660	0.3
AtA	Aneth sandy clay loam, strongly alkali, 0 to 3 percent slopes	3,920	0.3
AUC	Aneth-Sheppard association, rolling	32,990	2.5
AV	Aquic Ustifluvents-Typic Fluvaquents association, gently sloping	15,195	1.1
BA	Badland	57,525	4.3
BD	Badland-Typic Torrifluvents association, steep	30,910	2.3
BbD	Begay loamy fine sand, 3 to 8 percent slopes	9,780	0.7
DeE	Deleco loamy fine sand, 12 to 55 percent slopes	3,900	0.3
DMD	Deleco-Monue association, sloping	40,400	3.0
DND	Deleco-Nakai-Rock outcrop association, sloping	24,410	1.8
GoB	Gotho fine sandy loam, 1 to 8 percent slopes	1,925	0.1
GtA	Gotho soils, 0 to 3 percent slopes	2,690	0.2
HaD	Hoskinnini very fine sandy loam, very shallow, 2 to 5 percent slopes	4,400	0.3
HmD	Hoskinnini-Rock outcrop complex, 2 to 8 percent slopes	42,400	3.2
LAG	Lithic Torriorthents-Typic Torriorthents-Rock outcrop association, steep	124,440	9.4
LLG	Lithic Torriorthents-Rock outcrop, limestone complex, steep	6,350	0.5
MaE	Mespun fine sand, 2 to 10 percent slopes	6,020	0.5
MbD	Moenkopie sandy loam, 3 to 8 percent slopes	28,370	2.1
McF	Moenkopie-Rock outcrop complex, 8 to 25 percent slopes	17,730	1.3
MeD	Moepitz very fine sand, 3 to 8 percent slopes	13,785	1.0
MFD	Moepitz-Monue association, gently sloping	1,860	0.1
MhD	Monue-Sheppard complex, 1 to 12 percent slopes	39,950	3.0
MoB	Mota loamy fine sand, 1 to 8 percent slopes	33,460	2.5
MRE	Mota-Moenkopie-Rock outcrop association, sloping	32,300	2.4
NaB	Nakai loamy fine sand, 1 to 8 percent slopes	5,410	0.4
NbC	Nakai very fine sandy loam, 2 to 6 percent slopes	38,425	2.9
NCF	Namon-Rock outcrop complex, 3 to 25 percent slopes	2,265	0.2
NDG	Namon-Rock outcrop complex, low rainfall, 25 to 55 percent slopes	7,980	0.6
NkD	Nepalto very fine sandy loam, 2 to 8 percent slopes	3,995	0.3
NnD	Neskahi fine sandy loam, 2 to 6 percent slopes	14,000	1.0
NOC	Neskahi-Oljeto association, sloping	1,420	0.1
OJD	Oljeto-Sheppard association, sloping	12,140	0.9
PcD	Pickrell loamy fine sand, 2 to 6 percent slopes	14,925	1.1
PrE	Piute-Rock outcrop complex, 3 to 25 percent slopes	13,325	1.0
PsE	Piute-Rock outcrop complex, high rainfall, 3 to 25 percent slopes	18,625	1.4
PY	Playas	1,050	0.1
RaE	Raplee very fine sandy loam, 2 to 12 percent slopes	12,750	1.0
RED	Redbank-Shedado association, sloping	1,185	0.1
RH	Riverwash	895	0.1
RO	Rock outcrop	37,250	2.8
RRG	Rock outcrop, sandstone-Lithic Torriorthents association, steep	203,600	15.2
RSG	Rock outcrop-Moenkopie association, steep	51,180	3.8
SaE	Shedado loamy fine sand, 1 to 8 percent slopes	10,430	0.8
ShD	Sheppard fine sand, hummocky	44,020	3.3
ShE	Sheppard fine sand, rolling	21,310	1.6
SkE	Sheppard fine sand, high rainfall, hummocky	3,970	0.3
SME	Sheppard-Rock outcrop association, hummocky	1,620	0.1
SnB	Sogzie very fine sandy loam, 1 to 8 percent slopes	9,335	0.7
SoB	Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes	2,750	0.2
SSD	Sogzie-Sheppard association, sloping	15,940	1.2
TeA	Tezuma silt loam	2,665	0.2
TnC	Tohona sandy clay loam, 1 to 12 percent slopes	16,605	1.3
ToB	Tohona variant, very fine sandy loam, 1 to 8 percent slopes	1,825	0.1
TrD	Trail loamy sand, 1 to 8 percent slopes	1,315	0.1
UHG	Ustollic Haplargids-Ustic Torriorthents-Rock outcrop association, steep	23,715	1.8
WhB	Whit very fine sandy loam, 1 to 8 percent slopes	28,375	2.1
WkB	Whit very fine sandy loam, low rainfall, 1 to 8 percent slopes	17,240	1.3
	Water	30,500	2.3
	Total	1,336,185	100.0

TABLE 5.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AaC---------- Anasazi	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.
AaF---------- Anasazi	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: frost action.
AmB---------- Aneth	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
AnA---------- Aneth	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
AsA---------- Aneth	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
AtA---------- Aneth	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
AUC*:					
Aneth----------	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Sheppard---------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
AV*:					
Aquic Ustifluvents.					
Typic Fluvaquents.					
BA*. Badland					
BD*:					
Badland.					
Typic Torrifluvents.					
BbD---------- Begay	Slight----------	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
DeE---------- Deleco	Severe: slope, small stones, cemented pan.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
DMD*:					
Deleco----------	Severe: small stones, cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: slope, cemented pan.	Moderate: cemented pan.
Monue----------	Slight----------	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
DND*:					
Deleco	Severe: small stones, cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Moderate: slope, cemented pan.	Moderate: cemented pan.
Nakai	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Rock outcrop.					
GoB---- Gotho	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
GtA*:					
Gotho	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Gotho	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
HaD---- Hoskinnini	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
HmD*:					
Hoskinnini	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop.					
LAG*:					
Lithic Torriorthents.					
Typic Torriorthents.					
Rock outcrop.					
LLG*:					
Lithic Torriorthents.					
Rock outcrop (limestone).					
MaE---- Mespun	Severe: too sandy, cutbanks cave.	Slight----	Slight----	Moderate: slope.	Slight.
MbD---- Moenkopie	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, low strength.
McF*:					
Moenkopie	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: depth to rock, low strength.
Rock outcrop.					
MeD---- Moepitz	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, low strength.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
MFD*:					
Moepitz	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, low strength.
Monue	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
MhD*:					
Monue	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Sheppard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
MoB	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Mota					
MRE*:					
Mota	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Moenkopie	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, low strength.
Rock outcrop.					
NaB, NbC	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Nakai					
NCF*:					
Namon	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
Rock outcrop.					
NDG*:					
Namon	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Rock outcrop.					
NkD	Severe: floods, small stones.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Nepalto					
NnD	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Neskahi					
NOC*:					
Neskahi	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Oljeto	Severe: small stones.	Slight	Slight	Moderate: slope.	Slight.
OJD*:					
Oljeto	Severe: small stones.	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
OJD*:					
Sheppard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
PcD----------	Severe:	Severe:	Severe:	Severe:	Severe:
Pickrell	depth to rock.	depth to rock.	depth to rock.	depth to rock.	depth to rock.
PrE*, PsE*:					
Piute	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Rock outcrop.					
PY*.					
Playas					
RaE----------	Severe:	Moderate:	Severe:	Moderate:	Moderate:
Raplee	depth to rock.	low strength.	depth to rock.	slope, low strength.	low strength.
RED*:					
Redbank	Severe: cutbanks cave.	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Shedado	Severe: cutbanks cave, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: low strength, depth to rock.
RH*.					
Riverwash					
RO*.					
Rock outcrop					
RRG*:					
Rock outcrop.					
Lithic Torriorthents.					
RSG*:					
Rock outcrop.					
Moenkopie	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: depth to rock, low strength.
SaE----------	Severe:	Moderate:	Severe:	Moderate:	Moderate:
Shedado	cutbanks cave, depth to rock.	depth to rock.	depth to rock.	slope, depth to rock.	low strength, depth to rock.
ShD, ShE, SkE-----	Severe:	Slight	Slight	Moderate:	Slight.
Sheppard	cutbanks cave.			slope.	
SME*:					
Sheppard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Rock outcrop.					
SnB, SoB----------	Slight	Moderate:	Moderate:	Moderate:	Moderate:
Sogzie		low strength.	low strength.	slope, low strength.	low strength.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
SSD*: Sogzie	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Sheppard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
TeA--Tezuma	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
TnC--Tohona	Moderate: depth to rock.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
ToB--Tohona variant	Severe: depth to rock.	Moderate: low strength, depth to rock.	Severe: depth to rock.	Moderate: slope, low strength, depth to rock.	Moderate: low strength, depth to rock.
TrD--Trail	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
UHG*: Ustollic Haplargids. Ustic Torriorthents. Rock outcrop.					
WhB, WkB--Whit	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.

* See map unit description for the composition and behavior of the map unit.

TABLE 6.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AaC---------- Anasazi	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Slight----------	----------
AaF---------- Anasazi	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock.	Severe: slope.	----------
AmB---------- Aneth	Moderate: floods.	Severe: floods, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
AnA---------- Aneth	Slight----------	Moderate: seepage.	Moderate: too sandy.	Slight----------	Fair: too sandy.
AsA---------- Aneth	Moderate: floods.	Severe: floods, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
AtA---------- Aneth	Slight----------	Moderate: seepage.	Moderate: too sandy.	Slight----------	Fair: too sandy.
AUC*: Aneth----------	Moderate: floods.	Severe: floods, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
Sheppard----------	Slight----------	Severe: seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
AV*: Aquic Ustifluvents.					
Typic Fluvaquents.					
BA*. Badland.					
BD*: Badland.					
Typic Torrifluvents.					
BbD---------- Begay	Slight----------	Severe: seepage.	Slight----------	Slight----------	Good.
DeE---------- Deleco	Severe: slope, cemented pan.	Severe: slope, cemented pan.	Severe: slope, cemented pan.	Severe: slope.	Poor: slope, thin layer, area reclaim.
DMD*: Deleco----------	Severe: cemented pan.	Severe: slope, cemented pan.	Severe: cemented pan.	Slight----------	Poor: thin layer, area reclaim.
Monue----------	Severe: depth to rock.	Severe: slope, seepage.	Severe: depth to rock.	Slight----------	Good.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
DND*:					
Deleco	Severe: cemented pan.	Severe: slope, cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Nakai	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
Rock outcrop.					
GoB Gotho	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
GtA*:					
Gotho	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Gotho	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
HaD Hoskinnini	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
HmD*:					
Hoskinnini	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
Rock outcrop.					
LAG*:					
Lithic Torriorthents.					
Typic Torriorthents.					
Rock outcrop.					
LLG*:					
Lithic Torriorthents.					
Rock outcrop (limestone).					
MaE Mespun	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
MbD Moenkopie	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: seepage.	Poor: thin layer, area reclaim.
McF*:					
Moenkopie	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, area reclaim.
Rock outcrop.					
MeD Moepitz	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Slight	Poor: area reclaim.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MFD*:					
Moepitz	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Slight	Poor: area reclaim.
Monue	Severe: depth to rock.	Severe: seepage.	Severe: depth to rock.	Slight	Good.
MhD*:					
Monue	Severe: depth to rock.	Severe: seepage.	Severe: depth to rock.	Slight	Good.
Sheppard	Slight	Severe: seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
MoB Mota	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
MRE*:					
Mota	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
Moenkopie	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, area reclaim.
Rock outcrop.					
NaB, NbC Nakai	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
NCF*:					
Namon	Moderate: slope, depth to rock.	Severe: slope, seepage.	Severe: depth to rock.	Severe: seepage.	Poor: small stones.
Rock outcrop.					
NDG*:					
Namon	Severe: slope.	Severe: slope, seepage.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, small stones.
Rock outcrop.					
NkD Nepalto	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Poor: small stones, area reclaim.
NnD Neskahi	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
NOC*:					
Neskahi	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
Oljeto	Slight	Severe: seepage.	Slight	Slight	Poor: small stones, area reclaim.
OJD*:					
Oljeto	Slight	Severe: seepage.	Slight	Slight	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OJD*: Sheppard	Slight	Severe: slope, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
PcD: Pickrell	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
PrE*, PsE*: Piute	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Rock outcrop.					
PY*. Playas					
RaE: Raplee	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock.	Slight	Fair: thin layer.
RED*: Redbank	Slight	Severe: slope, seepage.	Slight	Slight	Fair: too sandy.
Shedado	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: too sandy, depth to rock.	Slight	Poor: too sandy, area reclaim.
RH*. Riverwash.					
RO*. Rock outcrop.					
RRG*: Rock outcrop.					
Lithic Torriorthents.					
RSG*: Rock outcrop.					
Moenkopie	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, area reclaim.
SaE: Shedado	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: too sandy, depth to rock.	Slight	Poor: too sandy, area reclaim.
ShD: Sheppard	Slight	Severe: slope, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
ShE: Sheppard	Slight	Severe: seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SkE---------- Sheppard	Slight----------	Severe: slope, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
SME*: Sheppard----------	Slight----------	Severe: slope, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
Rock outcrop.					
SnB, SoB---------- Sogzie	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
SSD*: Sogzie----------	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
Sheppard----------	Slight----------	Severe: slope, seepage.	Moderate: seepage, too sandy.	Moderate: seepage.	Fair: too sandy.
TeA---------- Tezuma	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, area reclaim.
TnC---------- Tohona	Severe: percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Fair: thin layer.
ToB---------- Tohona variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Poor: thin layer, area reclaim.
TrD---------- Trail	Moderate: floods.	Severe: floods, seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy, seepage.
UHG*: Ustollic Haplargids.					
Ustic Torriorthents.					
Rock outcrop.					
WhB, WkB---------- Whit	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Good.

* See map unit description for the composition and behavior of the map unit.

TABLE 7.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaC--- Anasazi	Poor: thin layer.	Unsuited---	Unsuited---	Poor: large stones.
AaF--- Anasazi	Poor: thin layer.	Unsuited---	Unsuited---	Poor: slope, large stones.
AmB--- Aneth	Good---	Unsuited---	Unsuited---	Poor: too sandy.
AnA--- Aneth	Good---	Unsuited---	Unsuited---	Poor: excess sodium, too sandy.
AsA--- Aneth	Good---	Unsuited---	Unsuited---	Fair: too clayey.
AtA--- Aneth	Good---	Unsuited---	Unsuited---	Poor: excess sodium.
AUC*:				
Aneth---	Good---	Unsuited---	Unsuited---	Poor: too sandy.
Sheppard---	Good---	Poor: excess fines.	Unsuited---	Poor: too sandy.
AV*:				
Aquic Ustifluvents.				
Typic Fluvaquents.				
BA*.				
Badland.				
BD*:				
Badland.				
Typic Torrifluvents.				
BbD--- Begay	Fair: low strength.	Unsuited---	Unsuited---	Good.
DeE--- Deleco	Poor: slope, area reclaim.	Unsuited---	Unsuited---	Poor: slope, small stones, area reclaim.
DMD*:				
Deleco---	Poor: area reclaim.	Unsuited---	Unsuited---	Poor: small stones, area reclaim.
Monue---	Fair: low strength.	Unsuited---	Unsuited---	Fair: too sandy.
DND*:				
Deleco---	Poor: area reclaim.	Unsuited---	Unsuited---	Poor: small stones, area reclaim.
Nakai---	Fair: low strength.	Unsuited---	Unsuited---	Good.

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DND*:				
Rock outcrop.				
GoB----------	Poor:	Unsuited----------	Unsuited----------	Poor:
Gotho	low strength.			excess sodium.
GtA*:				
Gotho----------	Poor:	Unsuited----------	Unsuited----------	Poor:
	low strength,			too clayey,
	shrink-swell.			excess sodium.
Gotho----------	Poor:	Unsuited----------	Unsuited----------	Poor:
	low strength,			too clayey,
	shrink-swell.			excess sodium.
HaD----------	Poor:	Unsuited----------	Unsuited----------	Poor:
Hoskinnini	thin layer,			small stones,
	area reclaim.			area reclaim.
HmD*:				
Hoskinnini----------	Poor:	Unsuited----------	Unsuited----------	Poor:
	thin layer,			small stones,
	area reclaim.			area reclaim.
Rock outcrop.				
LAG*:				
Lithic Torriorthents.				
Typic Torriorthents.				
Rock outcrop.				
LLG*:				
Lithic Torriorthents.				
Rock outcrop (limestone).				
MaE----------	Good----------	Poor:	Unsuited----------	Poor:
Mespun		excess fines.		too sandy.
MbD----------	Poor:	Unsuited----------	Unsuited----------	Poor:
Moenkopie	thin layer,			thin layer,
	area reclaim.			area reclaim.
McF*:				
Moenkopie----------	Poor:	Unsuited----------	Unsuited----------	Poor:
	thin layer,			thin layer,
	area reclaim.			area reclaim.
Rock outcrop.				
MeD----------	Poor:	Unsuited----------	Unsuited----------	Poor:
Moepitz	thin layer,			small stones,
	area reclaim.			area reclaim.
MFD*:				
Moepitz----------	Poor:	Unsuited----------	Unsuited----------	Poor:
	thin layer,			small stones,
	area reclaim.			area reclaim.
Monue----------	Fair:	Unsuited----------	Unsuited----------	Fair:
	low strength.			too sandy.

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MhD*:				
Monue	Fair: low strength.	Unsuited	Unsuited	Fair: too sandy.
Sheppard	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
MoB	Fair: low strength.	Unsuited	Unsuited	Fair: excess sodium.
Mota				
MRE*:				
Mota	Fair: low strength.	Unsuited	Unsuited	Fair: excess sodium.
Moenkopie	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: thin layer, area reclaim.
Rock outcrop.				
NaB	Fair: low strength.	Unsuited	Unsuited	Fair: too sandy.
Nakai				
NbC	Fair: low strength.	Unsuited	Unsuited	Good.
Nakai				
NCF*:				
Namon	Poor: large stones.	Unsuited	Unsuited	Poor: large stones.
Rock outcrop.				
NDG*:				
Namon	Poor: slope, large stones.	Unsuited	Unsuited	Poor: slope, large stones.
Rock outcrop.				
NkD	Good	Unsuited	Poor: excess fines.	Fair: small stones.
Nepalto				
NnD	Fair: low strength.	Unsuited	Unsuited	Good.
Neskahi				
NOC*:				
Neskahi	Fair: low strength.	Unsuited	Unsuited	Poor: too sandy.
Oljeto	Poor: area reclaim.	Unsuited	Good	Poor: too sandy, area reclaim.
OJD*:				
Oljeto	Poor: area reclaim.	Unsuited	Good	Poor: too sandy, area reclaim.
Sheppard	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
PcD	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: too sandy, area reclaim.
Pickrell				
PrE*, PsE*:				
Piute	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: too sandy, area reclaim.
Rock outcrop.				

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PY*. Playas				
RaE Raplee	Poor: thin layer.	Unsuited	Unsuited	Poor: excess salt.
RED*: Redbank	Fair: low strength.	Unsuited	Unsuited	Good.
Shedado	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: too sandy, area reclaim.
RH*. Riverwash.				
RO*. Rock outcrop.				
RRG*: Rock outcrop.				
Lithic Torriorthents.				
RSG*: Rock outcrop.				
Moenkopie	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: thin layer, area reclaim.
SaE Shedado	Poor: thin layer, area reclaim.	Unsuited	Unsuited	Poor: too sandy, area reclaim.
ShD, ShE, SkE Sheppard	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
SME*: Sheppard	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
Rock outcrop.				
SnB, SoB Sogzie	Fair: low strength.	Unsuited	Unsuited	Fair: excess sodium.
SSD*: Sogzie	Fair: low strength.	Unsuited	Unsuited	Fair: excess sodium.
Sheppard	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
TeA Tezuma	Poor: low strength, shrink-swell, area reclaim.	Unsuited	Unsuited	Fair: excess salt.
TnC Tohona	Poor: thin layer.	Unsuited	Unsuited	Fair: too clayey.
ToB Tohona variant	Poor: thin layer.	Unsuited	Unsuited	Fair: too clayey.
TrD Trail	Fair: low strength.	Poor: excess fines.	Unsuited	Poor: too sandy.

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

map symbol				
UHG*: Ustollic Haplargids. Ustic Torriorthents. Rock outcrop.				
WhB, WkB---------- Whit	Fair: low strength.	Unsuited----------	Unsuited----------	Fair: excess sodium.

* See map unit description for the composition and behavior of the map unit.

TABLE 8.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Terraces and diversions
AaC---------- Anasazi	Slope, depth to rock.	Low strength, piping, thin layer.	No water----------	Depth to rock, piping, slope.
AaF---------- Anasazi	Slope, depth to rock.	Low strength, piping, thin layer.	No water----------	Depth to rock, piping, slope.
AmB---------- Aneth	Slope, seepage.	Seepage, piping.	No water----------	Slope, too sandy, piping.
AnA---------- Aneth	Seepage----------	Seepage, piping.	No water----------	Too sandy, piping.
AsA---------- Aneth	Seepage----------	Seepage, piping.	No water----------	Too sandy, piping.
AtA---------- Aneth	Seepage----------	Seepage, piping.	No water----------	Too sandy, piping.
AUC*:				
Aneth----------	Slope, seepage.	Seepage, piping.	No water----------	Slope, too sandy, piping.
Sheppard---------	Slope, seepage.	Seepage, piping.	No water----------	Slope, piping, too sandy.
AV*:				
Aquic Ustifluvents.				
Typic Fluvaquents.				
BA*. Badland.				
BD*:				
Badland.				
Typic Torrifluvents.				
BbD---------- Begay	Slope, seepage.	Seepage, piping.	No water----------	Slope, piping.
DeE---------- Deleco	Slope, cemented pan.	Thin layer, piping.	No water----------	Slope, cemented pan.
DMD*:				
Deleco----------	Slope, cemented pan.	Thin layer, piping.	No water----------	Slope, cemented pan.
Monue----------	Slope, depth to rock, seepage.	Low strength, piping, thin layer.	No water----------	Depth to rock, piping.
DND*:				
Deleco----------	Slope, cemented pan.	Thin layer, piping.	No water----------	Slope, cemented pan.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Terraces and diversions
DND*:				
Nakai	Slope, seepage.	Low strength, piping.	No water	Piping.
Rock outcrop.				
GoB---------- Gotho	Slope----------	Low strength, piping.	No water----------	Piping, percs slowly.
GtA*:				
Gotho	Favorable----------	Low strength, piping.	No water----------	Piping, percs slowly.
Gotho	Favorable----------	Low strength, piping.	No water----------	Piping, percs slowly.
HaD---------- Hoskinnini	Slope, depth to rock.	Low strength, piping, thin layer.	No water----------	Depth to rock, piping.
HmD*:				
Hoskinnini	Slope, depth to rock.	Low strength, piping, thin layer.	No water----------	Depth to rock, piping.
Rock outcrop.				
LAG*:				
Lithic Torriorthents.				
Typic Torriorthents.				
Rock outcrop.				
LLG*:				
Lithic Torriorthents.				
Rock outcrop (limestone).				
MaE---------- Mespun	Slope, seepage.	Piping, seepage.	No water----------	Slope, erodes easily, too sandy.
MbD---------- Moenkopie	Depth to rock, slope.	Thin layer----------	No water----------	Depth to rock, rooting depth, erodes easily.
McF*:				
Moenkopie	Depth to rock, slope.	Thin layer----------	No water----------	Depth to rock, rooting depth, erodes easily.
Rock outcrop.				
MeD---------- Moepitz	Slope, depth to rock, seepage.	Low strength, piping, thin layer.	No water----------	Depth to rock, piping.
MFD*:				
Moepitz	Slope, depth to rock, seepage.	Low strength, piping, thin layer.	No water----------	Depth to rock, piping.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Terraces and diversions
MFD*:				
Monue	Slope, depth to rock, seepage.	Low strength, piping, thin layer.	No water	Depth to rock, piping.
MhD*:				
Monue	Slope, depth to rock, seepage.	Low strength, piping, thin layer.	No water	Depth to rock, piping.
Sheppard	Slope, seepage.	Seepage, piping.	No water	Slope, piping, too sandy.
MoB	Seepage, slope.	Seepage, piping.	No water	Slope, piping.
Mota				
MRE*:				
Mota	Seepage, slope.	Seepage, piping.	No water	Slope, piping.
Moenkopie	Depth to rock, slope.	Thin layer	No water	Depth to rock, rooting depth, erodes easily.
Rock outcrop.				
NaB, NbC	Slope, seepage.	Low strength, piping.	No water	Piping.
Nakai				
NCF*, NDG*:				
Namon	Slope, seepage, depth to rock.	Low strength, piping, hard to pack.	No water	Depth to rock, piping.
Rock outcrop.				
NkD	Slope, seepage.	Piping, seepage.	No water	Piping.
Nepalto				
NnD	Slope, seepage.	Seepage, piping.	No water	Slope, piping.
Neskahi				
NOC*:				
Neskahi	Slope, seepage.	Seepage, piping.	No water	Slope, piping.
Oljeto	Slope, seepage.	Seepage, piping.	No water	Piping, slope.
OJD*:				
Oljeto	Slope, seepage.	Seepage, piping.	No water	Piping, slope.
Sheppard	Slope, seepage.	Seepage, piping.	No water	Slope, piping, too sandy.
PcD	Slope, depth to rock.	Low strength, piping, thin layer.	No water	Depth to rock, piping.
Pickrell				

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Terraces and diversions
PrE*, PsE*: Piute	Slope, depth to rock, seepage.	Low strength, piping, thin layer.	No water	Depth to rock, piping.
Rock outcrop.				
PY*. Playas				
RaE---- Raplee	Slope, seepage, depth to rock.	Low strength, piping, thin layer.	No water	Depth to rock, piping.
RED*: Redbank	Slope, seepage.	Seepage, piping.	No water	Piping.
Shedado	Slope, seepage, depth to rock.	Low strength, piping, seepage.	No water	Slope, piping, depth to rock.
RH*. Riverwash.				
RO*. Rock outcrop.				
RRG*: Rock outcrop.				
Lithic Torriorthents.				
RSG*: Rock outcrop.				
Moenkopie	Depth to rock, slope.	Thin layer	No water	Depth to rock, rooting depth, erodes easily.
SaE---- Shedado	Slope, seepage, depth to rock.	Low strength, piping, seepage.	No water	Slope, piping, depth to rock.
ShD, ShE, SkE---- Sheppard	Slope, seepage.	Seepage, piping.	No water	Slope, piping, too sandy.
SME*: Sheppard	Slope, seepage.	Seepage, piping.	No water	Slope, piping, too sandy.
Rock outcrop.				
SnB, SoB---- Sogzie	Slope, seepage.	Seepage, piping.	No water	Slope, piping.
SSD*: Sogzie	Slope, seepage.	Seepage, piping.	No water	Slope, piping.
Sheppard	Slope, seepage.	Seepage, piping.	No water	Slope, piping, too sandy.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Terraces and diversions
TeA---------- Tezuma	Favorable----------	Low strength----------	No water----------	Low strength, percs slowly.
TnC---------- Tohona	Slope, depth to rock.	Low strength, piping.	No water----------	Slope, piping.
ToB---------- Tohona variant	Slope, depth to rock.	Low strength, piping.	No water----------	Slope, piping.
TrD---------- Trail	Seepage----------	Low strength, piping.	Deep to water---------	Too sandy, soil blowing, piping.
UHC*: Ustollic Haplargids.				
Ustic Torriorthents.				
Rock outcrop.				
WhB, WkB---------- Whit	Slope, seepage.	Piping----------	No water----------	Slope, piping.

* See map unit description for the composition and behavior of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
AaC	Moderate: large stones.	Moderate: large stones.	Severe: slope, large stones.	Moderate: large stones.
AaF Anasazi	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
AmB Aneth	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
AnA Aneth	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
AsA Aneth	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods, too clayey.	Moderate: too clayey.
AtA Aneth	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
AUC*: Aneth	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
AV*: Aquic Ustifluvents.				
Typic Fluvaquents.				
BA*. Badland.				
BD*: Badland.				
Typic Torrifluvents.				
BbD Begay	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
DeE Deleco	Severe: slope.	Severe: slope.	Severe: slope, cemented pan.	Severe: slope.
DMD*: Deleco	Moderate: too sandy.	Moderate: too sandy.	Severe: slope, cemented pan.	Moderate: too sandy.
Monue	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
DND*: Deleco	Slight	Slight	Severe: slope, cemented pan.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
DND*:				
Nakai	Slight	Slight	Slight	Slight.
Rock outcrop.				
GoB Gotho	Slight	Slight	Moderate: slope.	Slight.
GtA*:				
Gotho	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Gotho	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.
HaD Hoskinnini	Slight	Slight	Severe: depth to rock.	Slight.
HmD*:				
Hoskinnini	Moderate: small stones.	Moderate: small stones.	Severe: depth to rock, small stones.	Moderate: small stones.
Rock outcrop.				
LAG*:				
Lithic Torriorthents.				
Typic Torriorthents.				
Rock outcrop.				
LLG*:				
Lithic Torriorthents.				
Rock outcrop (limestone).				
MaE Mespun	Severe: too sandy.	Severe: too sandy.	Severe: too sandy, slope.	Severe: too sandy.
MbD Moenkopie	Slight	Slight	Severe: depth to rock.	Slight.
McF*:				
Moenkopie	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock.	Slight.
Rock outcrop.				
MeD Moepitz	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
MFD*:				
Moepitz	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
Monue	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
MhD*:				
Monue	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
MoB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Mota				
MRE*:				
Mota	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Moenkopie	Slight	Slight	Severe: depth to rock.	Slight.
Rock outcrop.				
NaB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Nakai				
NbC	Slight	Slight	Moderate: slope.	Slight.
Nakai				
NCF*:				
Namon	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.
Rock outcrop.				
NDG*:				
Namon	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.
Rock outcrop.				
NkD	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Nepalto				
NnD	Slight	Slight	Moderate: slope.	Slight.
Neskahi				
NOC*:				
Neskahi	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Oljeto	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
OJD*:				
Oljeto	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PcD Pickrell	Moderate: too sandy.	Moderate: too sandy.	Severe: depth to rock.	Moderate: too sandy.
PrE*, PsE*: Piute	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope, depth to rock.	Moderate: too sandy.
Rock outcrop.				
PY*. Playas				
RaE Raplee	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
RED*: Redbank	Slight	Slight	Severe: slope.	Slight.
Shedado	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Moderate: too sandy.
RH*. Riverwash.				
RO*. Rock outcrop.				
RRG*: Rock outcrop.				
Lithic Torriorthents.				
RSG*: Rock outcrop.				
Moenkopie	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock.	Slight.
SaE Shedado	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Moderate: too sandy.
ShD Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
ShE Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
SkE Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
SME*: Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Rock outcrop.				
SnB, SoB Sogzie	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SSD*:				
Sogzie	Slight	Slight	Moderate: slope.	Slight.
Sheppard	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
TeA Tezuma	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
TnC Tohona	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
ToB Tohona variant	Slight	Slight	Moderate: slope.	Slight.
TrD Trail	Moderate: too sandy, floods.	Moderate: too sandy.	Moderate: slope, floods.	Moderate: too sandy.
UHG*:				
Ustollic Haplargids.				
Ustic Torriorthents.				
Rock outcrop.				
WhB, WkB Whit	Slight	Slight	Moderate: slope.	Slight.

* See map unit description for the composition and behavior of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
AaC---- Anasazi	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
AaF---- Anasazi	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
AmB---- Aneth	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
AnA, AsA, AtA---- Aneth	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
AUC*:												
Aneth----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Sheppard----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
AV*:												
Aquic Ustifluvents.												
Typic Fluvaquents.												
BA*. Badland,												
BD*:												
Badland.												
Typic Torrifluvents.												
BbD---- Begay	Poor	Fair	Fair	---	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
DeE---- Deleco	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
DMD*:												
Deleco----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Monue----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
DND*:												
Deleco----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Nakai----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Rock outcrop.												
GoB---- Gotho	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
GtA*:												
Gotho----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
GtA*:												
Gotho	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
HaD	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Hoskinnini												
HmD*:												
Hoskinnini	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Rock outcrop.												
LAG*:												
Lithic Torriorthents.												
Typic Torriorthents.												
Rock outcrop.												
LLG*:												
Lithic Torriorthents.												
Rock outcrop (limestone).												
MaE	Very poor.	Very poor.	Fair	---	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Mespun												
MbD	Very poor.	Poor	Fair	---	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor.
Moenkopie												
McF*:												
Moenkopie	Very poor.	Poor	Fair	---	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor.
Rock outcrop.												
MeD	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Moepitz												
MFD*:												
Moepitz	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Monue	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
MhD*:												
Monue	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Sheppard	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
MoB	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Mota												
MRE*:												
Mota	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Moenkopie	Very poor.	Poor	Fair	---	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
MRE*: Rock outcrop.												
NaB, NbC---------- Nakai	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
NCF*, NDG*: Namon----------	Very poor.	Very poor.	Fair	---	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Rock outcrop.												
NkD---------- Nepalto	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
NnD---------- Neskahi	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
NOC*: Neskahi----------	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Oljeto----------	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
OJD*: Oljeto----------	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Sheppard----------	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
PcD---------- Pickrell	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
PrE*, PsE*: Piute----------	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.												
PY*. Playas												
RaE---------- Raplee	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
RED*: Redbank----------	Poor	Fair	Fair	---	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Shedado----------	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
RH*. Riverwash												
RO*. Rock outcrop												
RRG*: Rock outcrop.												
Lithic Torriorthents.												

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
RSG*:												
Rock outcrop.												
Moenkopie	Very poor.	Poor	Fair	---	Very poor.	Fair	Poor	Very poor.	Poor	---	Very poor.	Fair.
SaE Shedado	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
ShD, ShE, SkE Sheppard	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
SME*:												
Sheppard	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Rock outcrop.												
SnB, SoB Sogzie	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
SSD*:												
Sogzie	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Sheppard	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
TeA Tezuma	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
TnC Tohona	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
ToB Tohona variant	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
TrD Trail	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
UHG*:												
Ustollic Haplargids.												
Ustic Torriorthents.												
Rock outcrop.												
WhB, WkB Whit	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.

* See map unit description for the composition and behavior of the map unit.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AaC---------- Anasazi	0-4	Very stony very fine sandy loam.	SM, ML	A-4	5-25	75-100	75-100	60-95	35-60	15-20	NP-5
	4-24	Fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	75-100	75-100	60-85	35-55	15-20	NP-5
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
AaF---------- Anasazi	0-4	Very stony very fine sandy loam.	SM, ML	A-4	5-25	75-100	75-100	60-95	35-60	15-20	NP-5
	4-24	Fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	75-100	75-100	60-85	35-55	15-20	NP-5
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
AmB---------- Aneth	0-7	Loamy fine sand	SM	A-2	0	100	100	75-90	20-35	15-25	NP-5
	7-36	Loamy fine sand, fine sandy loam.	SM	A-2, A-4	0	100	100	80-95	25-45	15-25	NP-5
	36-60	Loamy fine sand	SM	A-2	0	100	100	80-95	15-25	15-25	NP-5
AnA---------- Aneth	0-7	Loamy fine sand	SM	A-2	0	100	100	75-90	20-35	15-25	NP-5
	7-36	Loamy fine sand, fine sandy loam.	SM, SM-SC	A-2, A-4	0	100	100	80-95	25-45	15-25	NP-10
	36-60	Loamy fine sand	SM	A-2	0	100	100	80-95	15-25	15-25	NP-5
AsA---------- Aneth	0-7	Sandy clay loam	SM-SC, CL-ML	A-4	0	100	100	80-90	35-55	25-30	5-10
	7-36	Loamy fine sand, fine sandy loam.	SM	A-2, A-4	0	100	100	80-95	25-45	15-25	NP-5
	36-60	Loamy fine sand	SM	A-2	0	100	100	80-95	15-25	15-25	NP-5
AtA---------- Aneth	0-7	Sandy clay loam	SM-SC, CL-ML	A-4	0	100	100	80-90	35-55	25-30	5-10
	7-36	Loamy fine sand, fine sandy loam.	SM	A-2, A-4	0	100	100	80-95	25-45	15-25	NP-10
	36-60	Loamy fine sand	SM	A-2	0	100	100	80-95	15-25	15-25	NP-5
AUC*:											
Aneth----------	0-7	Loamy fine sand	SM	A-2	0	100	100	75-90	20-35	15-25	NP-5
	7-36	Loamy fine sand, fine sandy loam.	SM	A-2, A-4	0	100	100	80-95	25-45	15-25	NP-5
	36-60	Loamy fine sand	SM	A-2	0	100	100	80-95	15-25	15-25	NP-5
Sheppard----------	0-12	Fine sand-------	SM	A-2	0	100	100	65-80	10-20	---	NP
	12-60	Loamy fine sand	SM	A-2	0	100	100	70-80	15-25	---	NP
AV*: Aquic Ustifluvents.											
Typic Fluvaquents.											
BA*. Badland.											
BD*: Badland.											
Typic Torrifluvents.											

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BbD Begay	0-3	Loamy fine sand	SM	A-2, A-4	0	100	100	75-90	30-50	20-25	NP-5
	3-60	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	20-30	NP-10
DeE Deleco	0-3	Loamy fine sand	SM	A-2, A-4	0	75-90	70-85	50-75	30-50	---	NP
	3-7	Gravelly sandy loam.	SM, GM	A-2, A-1	0	55-85	50-75	35-55	15-30	---	NP
	7-10	Very gravelly sandy loam.	GM, GP-GM	A-1	0	20-55	15-50	10-35	5-20	---	NP
	10-14	Indurated	---	---	---	---	---	---	---	---	---
	14-45	Sandy loam	SM	A-2, A-4	0	100	100	60-70	30-40	20-25	NP-5
DMD*: Deleco	0-9	Fine sand	SM	A-2, A-4	0	75-90	70-85	50-75	30-50	---	NP
	9-17	Gravelly sandy loam.	SM, GM	A-2, A-1	0	55-85	50-75	35-55	15-30	---	NP
	17	Indurated	---	---	---	---	---	---	---	---	---
Monue	0-13	Loamy fine sand	SM	A-2, A-4	0	100	100	80-95	30-50	15-25	NP-5
	13-46	Very fine sandy loam, fine sandy loam.	ML, SM	A-4	0	100	100	80-95	45-65	20-25	NP-5
	46	Weathered bedrock.	---	---	---	---	---	---	---	---	---
DND*: Deleco	0-3	Sandy loam	SM	A-2, A-4	0	75-90	70-85	50-75	30-50	---	NP
	3-9	Gravelly sandy loam.	SM, GM	A-2, A-1	0	55-85	50-75	35-55	15-30	---	NP
	9-14	Very gravelly sandy loam.	GM, GP-GM	A-1	0	20-55	15-50	10-35	5-20	---	NP
	14	Indurated	---	---	---	---	---	---	---	---	---
Nakai	0-27	Very fine sandy loam.	SM, ML	A-2, A-4	0	100	100	75-90	30-60	15-25	NP-5
	27-54	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	100	70-95	45-65	15-25	NP-5
	54-66	Loamy fine sand	SM	A-2, A-4	0	100	100	75-90	30-50	15-25	NP-5
Rock outcrop.											
GoB	0-6	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	40-60	15-25	NP-5
	6-60	Sandy clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-75	25-35	5-15
GtA*: Gotho	0-4	Clay	CL	A-6, A-7	0	100	100	90-100	75-95	35-50	15-25
	4-16	Clay	CL	A-6, A-7	0	100	100	90-100	75-95	35-50	15-25
	16-60	Sandy clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-75	25-35	5-15
Gotho	0-4	Sandy clay loam	CL, CL-ML	A-4, A-6	0	100	100	80-90	55-75	25-35	5-15
	4-16	Clay	CL	A-6, A-7	0	100	100	90-100	75-95	35-50	15-25
	16-60	Sandy clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-75	25-35	5-15
HaD Hoskinnini	0-4	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	20-30	NP-10
	4-11	Gravelly fine sandy loam, sandy clay loam.	SM	A-2, A-4	0	65-100	60-85	45-65	30-45	20-25	NP-5
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HmD*:											
Hoskinnini--------	0-1	Gravelly fine sandy loam.	SM, GM	A-2	0	60-75	55-70	40-55	25-35	20-25	NP-5
	1-12	Gravelly fine sandy loam, sandy clay loam.	SM	A-2, A-4	0	65-100	60-85	45-65	30-45	20-25	NP-5
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
LAG*:											
Lithic Torriorthents.											
Typic Torriorthents.											
Rock outcrop.											
LLG*:											
Lithic Torriorthents.											
Rock outcrop (limestone).											
MaE----------	0-18	Fine sand-------	SM, SP-SM	A-3, A-2	0	100	100	70-95	5-25	---	NP
Mespun	18-60	Fine sand, loamy fine sand.	SM, SP-SM	A-3, A-2	0	100	100	70-95	5-35	---	NP
MbD----------	0-15	Sandy loam------	SM	A-4	0	95-100	95-100	65-75	35-45	20-25	NP-5
Moenkopie	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
McF*:											
Moenkopie---------	0-12	Fine sandy loam	SM	A-4	0	95-100	95-100	65-75	35-45	20-25	NP-5
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
MeD----------	0-10	Very fine sand	SM	A-2, A-4	0	100	100	75-90	30-50	15-25	NP-5
Moepitz	10-30	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	20-25	NP-5
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MFD*:											
Moepitz----------	0-10	Gravelly loamy fine sand.	GM	A-4	0	55-65	50-60	45-55	35-45	20-25	NP-5
	10-36	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	20-25	NP-5
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Monue----------	0-13	Loamy fine sand	SM	A-2, A-4	0	100	100	80-95	30-50	15-25	NP-5
	13-46	Very fine sandy loam, fine sandy loam.	ML, SM	A-4	0	100	100	80-95	45-65	20-25	NP-5
	46	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MhD*:											
Monue	0-13	Loamy fine sand	SM	A-2, A-4	0	100	100	80-95	30-50	15-25	NP-5
	13-46	Very fine sandy loam, fine sandy loam.	ML, SM	A-4	0	100	100	80-95	45-65	20-25	NP-5
	46	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Sheppard	0-12	Fine sand	SM	A-2	0	100	100	65-80	10-20	---	NP
	12-60	Loamy fine sand	SM	A-2	0	100	100	70-80	15-25	---	NP
MoB	0-6	Loamy fine sand	SM	A-4	0	100	90-100	70-80	35-50	15-25	NP-5
Mota	6-23	Very fine sandy loam.	ML	A-4	0	100	100	80-95	75-90	15-25	NP-5
	23-60	Loamy very fine sand.	ML	A-4	0	100	100	90-95	50-60	15-25	NP-5
MRE*:											
Mota	0-6	Loamy fine sand	SM	A-4	0	100	90-100	70-80	35-50	15-25	NP-5
	6-23	Very fine sandy loam.	ML	A-4	0	100	100	80-95	75-90	15-25	NP-5
	23-60	Loamy very fine sand.	ML	A-4	0	100	100	90-95	50-60	15-25	NP-5
Moenkopie	0-15	Sandy loam	SM	A-4	0	95-100	95-100	65-75	35-45	20-25	NP-5
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
NaB	0-18	Loamy fine sand	SM, ML	A-2, A-4	0	100	100	75-90	30-60	15-25	NP-5
Nakai	18-34	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	100	70-95	45-65	15-25	NP-5
	34-60	Loamy fine sand	SM	A-2, A-4	0	100	100	75-90	30-50	15-25	NP-5
NbC	0-30	Very fine sandy loam.	SM, ML	A-2, A-4	0	100	100	75-90	30-60	15-25	NP-5
Nakai	30-54	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	100	70-95	45-65	15-25	NP-5
	54-60	Loamy fine sand	SM	A-2, A-4	0	100	100	75-90	30-50	15-25	NP-5
NCF*, NDG*:											
Namon	0-5	Very cobbly very fine sandy loam.	GM, SM	A-2, A-4	55-80	50-75	45-70	40-60	25-40	15-25	NP-5
	5-21	Cobbly very fine sandy loam.	SM	A-2, A-4	45-55	70-80	65-75	55-70	30-45	15-25	NP-5
	21-48	Very cobbly very fine sandy loam, very cobbly sandy loam.	SM, GM	A-2, A-4, A-1	60-80	40-75	35-70	30-65	20-40	15-25	NP-5
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
NkD	0-12	Very fine sandy loam.	ML	A-4	0	100	75-90	65-85	50-65	15-20	NP-5
Nepalto	12-31	Gravelly loamy fine sand.	GM	A-1	0	40-60	40-60	25-45	10-20	---	NP
	31-60	Very gravelly sand.	GP	A-1	0	30-40	25-35	15-30	0-5	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NnD---------- Neskahi	0-6	Fine sandy loam	SM, ML	A-4	0	100	100	75-90	40-60	15-25	NP-5
	6-60	Very fine sandy loam, fine sandy loam, loam.	ML	A-4	0	100	100	75-90	50-70	15-25	NP-5
NOC*:											
Neskahi----------	0-6	Loamy fine sand	SM, ML	A-4	0	100	100	75-90	35-55	15-25	NP-5
	6-60	Very fine sandy loam, fine sandy loam, loam.	ML	A-4	0	100	100	75-90	50-70	15-25	NP-5
Oljeto----------	0-20	Loamy fine sand	SM	A-4	0	90-100	85-100	60-75	35-50	---	NP
	20-60	Very gravelly loamy sand, very gravelly loamy coarse sand.	GP, GP-GM	A-1	0	20-40	15-35	10-25	0-10	---	NP
OJD*:											
Oljeto----------	0-20	Loamy fine sand	SM	A-4	0	90-100	85-100	60-75	35-50	---	NP
	20-60	Very gravelly loamy sand, very gravelly loamy coarse sand.	GP, GP-GM	A-1	0	20-40	15-35	10-25	0-10	---	NP
Sheppard----------	0-12	Fine sand-------	SM	A-2	0	100	100	65-80	10-20	---	NP
	12-60	Loamy fine sand	SM	A-2	0	100	100	70-80	15-25	---	NP
PcD---------- Pickrell	0-5	Loamy fine sand	SM, ML	A-4	0	100	100	75-90	35-55	15-25	NP-5
	5-18	Loamy fine sand, gravelly loamy fine sand.	SM, ML	A-2, A-4	0	70-100	65-100	65-90	30-55	15-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
PrE*, PsE*:											
Piute----------	0-9	Loamy fine sand	SM	A-2, A-4	0	100	100	80-100	30-50	15-25	NP-5
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
PY*. Playas											
RaE---------- Raplee	0-4	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	20-25	NP-10
	4-22	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	20-25	NP-10
	22-36	Weathered bedrock.	---	---	---	---	---	---	---	---	---
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RED*:											
Redbank----------	0-28	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-65	15-25	NP-10
	28-42	Loamy fine sand	SM	A-4, A-2	0	100	100	75-90	30-50	15-25	NP-5
	42-60	Fine sandy loam	CL-ML, ML, SM-SC, SM	A-4	0	100	100	70-85	45-55	20-30	NP-10

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RED*:											
Shedado	0-7	Loamy very fine sand.	ML	A-4	0	100	100	90-95	50-60	15-25	NP-5
	7-15	Very fine sand	ML, SM	A-4	0	100	100	75-90	35-55	15-25	NP-5
	15-35	Loamy very fine sand.	ML	A-4	0	100	100	90-95	50-60	15-25	NP-5
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RH*.											
Riverwash											
RO*.											
Rock outcrop											
RRG*:											
Rock outcrop.											
Lithic Torriorthents.											
RSG*:											
Rock outcrop.											
Moenkopie	0-12	Fine sandy loam	SM	A-4	0	95-100	95-100	65-75	35-45	20-25	NP-5
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SaE	0-7	Loamy very fine sand.	ML	A-4	0	100	100	90-95	50-60	15-25	NP-5
Shedado	7-15	Very fine sand	ML, SM	A-4	0	100	100	75-90	35-55	15-25	NP-5
	15-35	Loamy very fine sand.	ML	A-4	0	100	100	90-95	50-60	15-25	NP-5
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ShD, ShE, SkE	0-12	Fine sand	SM	A-2	0	100	100	65-80	10-20	---	NP
Sheppard	12-60	Loamy fine sand	SM	A-2	0	100	100	70-80	15-25	---	NP
SME*:											
Sheppard	0-12	Fine sand	SM	A-2	0	100	100	65-80	10-20	---	NP
	12-60	Loamy fine sand	SM	A-2	0	100	100	70-80	15-25	---	NP
Rock outcrop.											
SnB, SoB	0-5	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	55-75	15-25	NP-10
Sogzie	5-21	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	55-75	15-25	NP-10
	21-60	Fine sandy loam, very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	70-85	45-55	15-25	NP-10
SSD*:											
Sogzie	0-5	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	55-75	15-25	NP-10
	5-21	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	55-75	15-25	NP-10
	21-60	Fine sandy loam, very fine sandy loam.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	70-85	45-55	15-25	NP-10
Sheppard	0-12	Fine sand	SM	A-2	0	100	100	65-80	10-20	---	NP
	12-60	Loamy fine sand	SM	A-2	0	100	100	70-80	15-25	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
TeA----------	0-4	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	90-100	75-90	25-35	5-15
Tezuma	4-18	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	90-100	75-90	25-35	5-15
	18-60	Silty clay------	CH	A-7	0	100	100	95-100	90-95	50-60	30-40
TnC----------	0-5	Sandy clay loam	CL, CL-ML	A-4, A-6	0	100	100	80-90	55-75	25-35	5-15
Tohona	5-20	Sandy clay loam	CL, CL-ML	A-4, A-6	0	100	100	80-90	55-75	25-35	5-15
	20-34	Sandy clay loam	CL, CL-ML	A-4, A-6	0	100	100	80-90	55-75	25-35	5-15
	34-52	Weathered bedrock.	---	---	---	---	---	---	---	---	---
	52	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ToB----------	0-6	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	55-75	20-30	NP-10
Tohona variant	6-18	Sandy clay loam	CL-ML, CL	A-4, A-6	0	100	100	80-90	55-75	25-35	5-15
	18-34	Sandy clay loam	CL-ML, CL	A-4, A-6	0	100	100	80-90	55-75	25-35	5-15
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
TrD----------	0-12	Loamy fine sand	SM	A-2	0	100	100	70-85	20-35	---	NP
Trail	12-60	Loamy fine sand	SM	A-2	0	100	100	70-85	20-35	---	NP
UHG*:											
Ustollic Haplargids.											
Ustic Torriorthents.											
Rock outcrop.											
WhB, WkB----------	0-4	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	75-85	20-30	NP-10
Whit	4-30	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	75-85	20-30	NP-10
	30-60	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	75-85	20-30	NP-10

* See map unit description for the composition and behavior of the map unit.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
AaC	0-4	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low	High	Moderate	0.24	1	8
Anasazi	4-24	2.0-6.0	0.09-0.12	7.4-9.0	<2	Low	High	Moderate	0.32		
	24	---	---	---	---	---	---	---	---		
AaF	0-4	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low	High	Moderate	0.24	1	8
Anasazi	4-24	2.0-6.0	0.09-0.12	7.4-9.0	<2	Low	High	Moderate	0.32		
	24	---	---	---	---	---	---	---	---		
AmB	0-7	2.0-6.0	0.08-0.10	7.9-9.0	<2	Low	High	Moderate	0.49	5	2
Aneth	7-36	2.0-6.0	0.08-0.12	7.9-9.0	<2	Low	High	Moderate	0.49		
	36-60	2.0-6.0	0.08-0.10	7.9-9.0	<2	Low	High	Moderate	0.49		
AnA	0-7	0.6-2.0	0.08-0.10	7.9-9.0	<4	Low	High	Moderate	0.49	5	2
Aneth	7-36	0.6-2.0	0.08-0.12	7.9-9.0	<4	Low	High	Moderate	0.49		
	36-60	0.6-2.0	0.08-0.10	7.9-9.0	<4	Low	High	Moderate	0.49		
AsA	0-7	0.6-6.0	0.13-0.19	7.9-9.0	<2	Low	High	Moderate	0.28	5	5
Aneth	7-36	2.0-6.0	0.08-0.12	7.9-9.0	<2	Low	High	Moderate	0.49		
	36-60	2.0-6.0	0.08-0.10	7.9-9.0	<2	Low	High	Moderate	0.49		
AtA	0-7	0.2-2.0	0.13-0.19	7.9-9.0	<4	Low	High	Moderate	0.28	5	5
Aneth	7-36	0.6-2.0	0.08-0.12	7.9-9.0	<4	Low	High	Moderate	0.49		
	36-60	0.6-2.0	0.08-0.10	7.9-9.0	<4	Low	High	Moderate	0.49		
AUC*:											
Aneth	0-7	2.0-6.0	0.08-0.10	7.9-9.0	<2	Low	High	Moderate	0.49	5	2
	7-36	2.0-6.0	0.08-0.12	7.9-9.0	<2	Low	High	Moderate	0.49		
	36-60	2.0-6.0	0.08-0.10	7.9-9.0	<2	Low	High	Moderate	0.49		
Sheppard	0-12	6.0-20	0.05-0.07	7.4-8.4	<2	Low	High	Moderate	0.10	5	1
	12-60	6.0-20	0.06-0.08	7.4-8.4	<2	Low	High	Moderate	0.10		
AV*:											
Aquic Ustifluvents.											
Typic Fluvaquents.											
BA*.											
Badland.											
BD*:											
Badland.											
Typic Torrifluvents.											
BbD	0-3	2.0-6.0	0.08-0.11	7.4-8.4	<2	Low	High	Moderate	0.49	5	2
Begay	3-60	2.0-6.0	0.13-0.18	7.4-9.0	<2	Low	High	Moderate	0.43		
DeE	0-3	2.0-6.0	0.08-0.09	7.4-9.0	<2	Low	High	Moderate	0.37	1	2
Deleco	3-7	2.0-6.0	0.07-0.08	7.4-9.0	<2	Low	High	Moderate	0.15		
	7-10	2.0-6.0	0.05-0.06	7.4-9.0	<2	Low	High	Moderate	0.10		
	10-14	---	---	---	---	---	---	---	---		
	14-45	<0.06	0.	>9.0	<2	Low	High	Moderate	0.49		
DMD*:											
Deleco	0-9	2.0-6.0	0.08-0.09	7.4-9.0	<2	Low	High	Moderate	0.37	1	2
	9-17	2.0-6.0	0.07-0.08	7.4-9.0	<2	Low	High	Moderate	0.15		
	17	---	---	---	---	---	---	---	---		
Monue	0-13	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.37	3	2
	13-46	2.0-6.0	0.10-0.16	7.9-9.0	<2	Low	High	Moderate	0.37		
	46	---	---	---	---	---	---	---	---		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
DND*:											
Deleco	0-3	2.0-6.0	0.08-0.09	7.4-9.0	<2	Low	High	Moderate	0.37	1	2
	3-9	2.0-6.0	0.07-0.08	7.4-9.0	<2	Low	High	Moderate	0.15		
	9-14	2.0-6.0	0.05-0.06	7.4-9.0	<2	Low	High	Moderate	0.10		
	14	---	---	---	---	---	---	---	---		
Nakai	0-27	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.28	5	2
	27-54	2.0-6.0	0.10-0.18	8.5-9.0	<2	Low	High	Moderate	0.24		
	54-66	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.28		
Rock outcrop.											
GoB	0-6	0.6-2.0	0.12-0.15	8.5-9.0	<2	Low	High	Moderate	0.43	5	4
	6-60	0.2-0.6	0.17-0.19	>9.0	2-4	Moderate	High	Moderate	0.24		
GtA*:											
Gotho	0-4	0.06-0.2	0.17-0.19	>9.0	<2	High	High	Moderate	0.32	5	4
	4-16	0.06-0.2	0.17-0.19	8.5-9.0	2-4	High	High	Moderate	0.32		
	16-60	0.2-0.6	0.17-0.19	>9.0	2-4	Moderate	High	Moderate	0.24		
Gotho	0-4	0.2-0.6	0.17-0.19	8.5-9.0	<2	Moderate	High	Moderate	0.24	5	5
	4-16	0.06-0.2	0.17-0.19	8.5-9.0	2-4	High	High	Moderate	0.32		
	16-60	0.2-0.6	0.17-0.19	>9.0	2-4	Moderate	High	Moderate	0.24		
HaD	0-4	2.0-6.0	0.13-0.19	7.9-9.0	<2	Low	High	Moderate	0.43	1	2
Hoskinnini	4-11	0.6-2.0	0.10-0.14	7.9-9.0	<2	Low	High	Moderate	0.28		
	11	---	---	---	---	---	---	---	---		
HmD*:											
Hoskinnini	0-1	2.0-6.0	0.10-0.14	7.9-9.0	<2	Low	High	Moderate	0.28	1	8
	1-12	0.6-2.0	0.10-0.14	7.9-9.0	<2	Low	High	Moderate	0.28		
	12	---	---	---	---	---	---	---	---		
Rock outcrop.											
LAG*:											
Lithic Torriorthents.											
Typic Torriorthents.											
Rock outcrop.											
LLG*:											
Lithic Torriorthents.											
Rock outcrop (limestone).											
MaE	0-18	>20	0.05-0.08	6.6-8.4	<2	Low	High	Moderate	0.24	5	1
Mespun	18-60	6.0-20	0.05-0.09	6.6-8.4	<2	Low	High	Moderate	0.24		
MbD	0-15	2.0-6.0	0.11-0.13	7.9-8.4	<2	Low	High	High	0.37	1	---
Moenkopie	15	---	---	---	---	---	---	---	---		
McF*:											
Moenkopie	0-12	0.6-2.0	0.11-0.13	7.9-8.4	<2	Low	High	High	0.37	1	---
	12	---	---	---	---	---	---	---	---		
Rock outcrop.											
MeD	0-10	2.0-6.0	0.09-0.12	7.4-8.4	<2	Low	High	Moderate	0.49	3	1
Moepitz	10-30	2.0-6.0	0.09-0.13	7.4-8.4	<2	Low	High	Moderate	0.49		
	30	---	---	---	---	---	---	---	---		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
MFD*:											
Moepitz	0-10	2.0-6.0	0.07-0.09	7.9-9.0	<2	Low	High	Moderate	0.43	3	8
	10-36	2.0-6.0	0.09-0.13	7.9-9.0	<2	Low	High	Moderate	0.49		
	36	---	---	---	---	---	---	---	---		
Monue	0-13	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.37	3	2
	13-46	2.0-6.0	0.10-0.16	7.9-9.0	<2	Low	High	Moderate	0.37		
	46	---	---	---	---	---	---	---	---		
MhD*:											
Monue	0-13	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.37	3	2
	13-46	2.0-6.0	0.10-0.16	7.9-9.0	<2	Low	High	Moderate	0.37		
	46	---	---	---	---	---	---	---	---		
Sheppard	0-12	6.0-20	0.05-0.07	7.4-8.4	<2	Low	High	Moderate	0.10	5	1
	12-60	6.0-20	0.06-0.08	7.4-8.4	<2	Low	High	Moderate	0.10		
MoB	0-6	2.0-6.0	0.09-0.11	8.5-9.0	<2	Low	High	Moderate	0.43	5	2
Mota	6-23	2.0-6.0	0.14-0.16	8.5-9.0	<2	Low	High	Moderate	0.43		
	23-60	2.0-6.0	0.09-0.11	>9.0	<2	Low	High	Moderate	0.49		
MRE*:											
Mota	0-6	2.0-6.0	0.09-0.11	8.5-9.0	<2	Low	High	Moderate	0.43	5	2
	6-23	2.0-6.0	0.14-0.16	8.5-9.0	<2	Low	High	Moderate	0.43		
	23-60	2.0-6.0	0.09-0.11	>9.0	<2	Low	High	Moderate	0.49		
Moenkopie	0-15	0.6-2.0	0.11-0.13	7.9-9.0	<2	Low	High	High	0.37	1	---
	15	---	---	---	---	---	---	---	---		
Rock outcrop.											
NaB	0-18	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.28	5	2
Nakai	18-34	2.0-6.0	0.10-0.18	8.5-9.0	<2	Low	High	Moderate	0.24		
	34-60	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.28		
NbC	0-30	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.28	5	2
Nakai	30-54	2.0-6.0	0.10-0.18	8.5-9.0	<2	Low	High	Moderate	0.24		
	54-60	2.0-6.0	0.08-0.11	7.9-9.0	<2	Low	High	Moderate	0.28		
NCF*, NDG*:											
Namon	0-5	2.0-6.0	0.05-0.08	6.1-7.3	<2	Low	High	Moderate	0.32	1	8
	5-21	2.0-6.0	0.08-0.10	6.6-7.8	<2	Low	High	Moderate	0.43		
	21-48	2.0-20	0.04-0.07	6.6-7.8	<2	Low	High	Moderate	0.32		
	48	---	---	---	---	---	---	---	---		
Rock outcrop.											
NkD	0-12	2.0-6.0	0.08-0.11	7.9-8.4	<2	Low	High	Moderate	0.43	5	3
Nepalto	12-31	6.0-20	0.05-0.07	8.5-9.0	<2	Low	High	Moderate	0.15		
	31-60	6.0-20	0.02-0.04	8.5-9.0	<2	Low	High	Moderate	0.10		
NnD	0-6	2.0-6.0	0.11-0.13	7.9-9.0	<2	Low	High	Moderate	0.43	5	3
Neskahi	6-60	2.0-6.0	0.12-0.17	7.9-9.0	<2	Low	High	Moderate	0.43		
NOC*:											
Neskahi	0-6	2.0-6.0	0.06-0.11	7.9-9.0	<2	Low	High	Moderate	0.43	5	2
	6-60	2.0-6.0	0.12-0.17	7.9-9.0	<2	Low	High	Moderate	0.43		
Oljeto	0-20	2.0-6.0	0.08-0.10	7.4-8.4	<2	Low	High	Moderate	0.43	3	2
	20-60	6.0-20	0.02-0.04	7.9-9.0	<2	Low	High	Moderate	0.28		
OJD*:											
Oljeto	0-20	2.0-6.0	0.08-0.10	7.4-8.4	<2	Low	High	Moderate	0.43	3	2
	20-60	6.0-20	0.02-0.04	7.9-9.0	<2	Low	High	Moderate	0.28		
Sheppard	0-12	6.0-20	0.05-0.07	7.4-8.4	<2	Low	High	Moderate	0.10	5	1
	12-60	6.0-20	0.06-0.08	7.4-8.4	<2	Low	High	Moderate	0.10		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
PcD	0-5	2.0-6.0	0.07-0.09	7.9-9.0	<2	Low	High	Moderate	0.43	1	2
Pickrell	5-18	2.0-6.0	0.06-0.08	7.9-9.0	<2	Low	High	Moderate	0.43		
	18	---	---	---	---	---	---	---	---		
PrE*, PsE*:											
Piute	0-9	2.0-6.0	0.08-0.09	7.4-8.4	<2	Low	High	Moderate	0.43	1	2
	9	---	---	---	---	---	---	---	---		
Rock outcrop.											
PY*.											
Playas											
RaE	0-4	2.0-6.0	0.12-0.14	7.4-7.8	4-8	Low	High	High	0.49	2	3
Raplee	4-22	2.0-6.0	0.13-0.15	7.4-8.4	2-4	Low	High	High	0.49		
	22-36	---	---	---	---	---	---	---	---		
	36	---	---	---	---	---	---	---	---		
RED*:											
Redbank	0-28	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low	High	Moderate	0.43	5	3
	28-42	2.0-6.0	0.08-0.10	7.9-9.0	<2	Low	High	Moderate	0.43		
	42-60	2.0-6.0	0.11-0.13	8.5-9.0	<2	Low	High	Moderate	0.28		
Shedado	0-7	2.0-6.0	0.09-0.11	6.6-7.3	<2	Low	High	Moderate	0.49	2	2
	7-15	2.0-6.0	0.06-0.08	6.6-7.3	<2	Low	High	Moderate	0.43		
	15-35	2.0-6.0	0.09-0.11	6.6-7.8	<2	Low	High	Moderate	0.49		
	35	---	---	---	---	---	---	---	---		
RH*.											
Riverwash											
RO*.											
Rock outcrop											
RRG*:											
Rock outcrop.											
Lithic Torriorthents.											
RSG*:											
Rock outcrop.											
Moenkopie	0-12	0.6-2.0	0.11-0.13	7.9-8.4	<2	Low	High	High	0.37	1	---
	12	---	---	---	---	---	---	---	---		
SaE	0-7	2.0-6.0	0.09-0.11	6.6-7.3	<2	Low	High	Moderate	0.49	2	2
Shedado	7-15	2.0-6.0	0.06-0.08	6.6-7.3	<2	Low	High	Moderate	0.43		
	15-35	2.0-6.0	0.09-0.11	6.6-7.8	<2	Low	High	Moderate	0.49		
	35	---	---	---	---	---	---	---	---		
ShD, ShE, SkE	0-12	6.0-20	0.05-0.07	7.4-8.4	<2	Low	High	Moderate	0.10	5	1
Sheppard	12-60	6.0-20	0.06-0.08	7.4-9.0	<2	Low	High	Moderate	0.10		
SME*:											
Sheppard	0-12	6.0-20	0.05-0.07	7.4-8.4	<2	Low	High	Moderate	0.10	5	1
	12-60	6.0-20	0.06-0.08	7.4-8.4	<2	Low	High	Moderate	0.10		
Rock outcrop.											
SnB, SoB	0-5	0.6-2.0	0.15-0.17	7.9-9.0	<2	Low	High	Moderate	0.43	5	3
Sogzie	5-21	0.6-2.0	0.15-0.17	7.9-9.0	<2	Low	High	Moderate	0.43		
	21-60	0.6-6.0	0.11-0.13	7.9-8.4	<2	Low	High	Moderate	0.32		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
SSD*:											
Sogzie	0-5	0.6-2.0	0.15-0.17	7.9-9.0	<2	Low	High	Moderate	0.43	5	3
	5-21	0.6-2.0	0.15-0.17	7.9-9.0	<2	Low	High	Moderate	0.43		
	21-60	0.6-2.0	0.11-0.13	7.9-8.4	<2	Low	High	Moderate	0.32		
Sheppard	0-12	6.0-20	0.05-0.07	7.4-8.4	<2	Low	High	Moderate	0.10	5	1
	12-60	6.0-20	0.06-0.08	7.4-8.4	<2	Low	High	Moderate	0.10		
TeA	0-4	0.06-0.2	0.14-0.16	>8.4	4-8	Moderate	High	High	0.37	2	4L
Tezuma	4-18	0.2-0.6	0.14-0.16	7.9-9.0	4-8	High	High	High	0.37		
	18-60	0.06-0.2	0.11-0.13	7.9-9.0	8-16	High	High	High	0.17		
TnC	0-5	0.2-0.6	0.17-0.18	7.9-9.0	<2	Moderate	High	High	0.24	2	5
Tohona	5-20	0.2-0.6	0.17-0.18	>7.8	2-4	Moderate	High	High	0.24		
	20-34	0.2-0.6	0.17-0.18	7.9-9.0	8-16	Moderate	High	High	0.24		
	34-52	---	---	---	---	---	---	---	---		
	52	---	---	---	---	---	---	---	---		
ToB	0-6	0.6-2.0	0.16-0.17	8.5-9.0	<2	Low	High	High	0.43	2	3
Tohona variant	6-18	0.6-2.0	0.17-0.18	8.5-9.0	<2	Low	High	High	0.17		
	18-34	0.6-2.0	0.10-0.13	7.9-8.4	8-16	Low	High	High	0.17		
	34	---	---	---	---	---	---	---	---		
TrD	0-12	6.0-20	0.09-0.11	7.4-8.4	<2	Low	High	Low	0.32	5	---
Trail	12-60	6.0-20	0.09-0.11	7.4-8.4	<2	Low	High	Low	0.32		
UHG*:											
Ustollic Haplargids.											
Ustic Torriorthents.											
Rock outcrop.											
WhB, WkB	0-4	0.6-2.0	0.14-0.16	8.5-9.0	<2	Low	High	Moderate	0.43	3	3
Whit	4-30	0.6-2.0	0.14-0.16	7.9-9.0	<2	Low	High	Moderate	0.43		
	30-60	0.6-2.0	0.14-0.16	>7.8	<2	Low	High	Moderate	0.43		

* See map unit description for the composition and behavior of the map unit.

TABLE 13.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft			In		In	
AaC---------- Anasazi	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	---
AaF---------- Anasazi	C	None--------	---	---	>6.0	---	---	20-40	Hard	---	---
AmB---------- Aneth	A	Rare--------	---	---	>6.0	---	---	>60	---	---	---
AnA---------- Aneth	A	None--------	---	---	>6.0	---	---	>60	---	---	---
AsA---------- Aneth	A	Rare--------	---	---	>6.0	---	---	>60	---	---	---
AtA---------- Aneth	A	None--------	---	---	>6.0	---	---	>60	---	---	---
AUC*:											
Aneth----------	A	Rare--------	---	---	>6.0	---	---	>60	---	---	---
Sheppard---------	A	None--------	---	---	>6.0	---	---	>60	---	---	---
AV*:											
Aquic Ustifluvents.											
Typic Fluvaquents.											
BA*.											
Badland.											
BD*:											
Badland.											
Typic Torrifluvents.											
BbD---------- Begay	B	None--------	---	---	>6.0	---	---	>60	---	---	---
DeE---------- Deleco	C	None--------	---	---	>6.0	---	---	>60	---	7-20	Rippable
DMD*:											
Deleco----------	C	None--------	---	---	>6.0	---	---	20-40	Rippable	7-20	Rippable
Monue----------	B	None--------	---	---	>6.0	---	---	40-60	Rippable	---	---
DND*:											
Deleco----------	C	None--------	---	---	>6.0	---	---	>60	---	7-20	Rippable
Nakai----------	B	None--------	---	---	>6.0	---	---	>60	---	---	---
Rock outcrop.											
GoB---------- Gotho	C	None--------	---	---	>6.0	---	---	>60	---	---	---
GtA*:											
Gotho----------	C	None--------	---	---	>6.0	---	---	>60	---	---	---

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft			In		In	
GtA*: Gotho	C	None	---	---	>6.0	---	---	>60	---	---	---
HaD: Hoskinnini	D	None	---	---	>6.0	---	---	8-20	Hard	---	---
HmD*: Hoskinnini	D	None	---	---	>6.0	---	---	8-20	Hard	---	---
Rock outcrop.											
LAG*: Lithic Torriorthents.											
Typic Torriorthents.											
Rock outcrop.											
LLG*: Lithic Torriorthents.											
Rock outcrop (limestone).											
MaE: Mespun	A	None	---	---	>6.0	---	---	>60	---	---	---
MbD: Moenkopie	D	None	---	---	>6.0	---	---	5-20	Rippable	---	---
McF*: Moenkopie	D	None	---	---	>6.0	---	---	5-20	Rippable	---	---
Rock outcrop.											
MeD: Moepitz	B	None	---	---	>6.0	---	---	24-40	Hard	---	---
MFD*: Moepitz	B	None	---	---	>6.0	---	---	24-40	Hard	---	---
Monue	B	None	---	---	>6.0	---	---	40-60	Rippable	---	---
MhD*: Monue	B	None	---	---	>6.0	---	---	40-60	Rippable	---	---
Sheppard	A	None	---	---	>6.0	---	---	>60	---	---	---
MoB: Mota	B	None	---	---	>6.0	---	---	>60	---	---	---
MRE*: Mota	B	None	---	---	>6.0	---	---	>60	---	---	---
Moenkopie	D	None	---	---	>6.0	---	---	5-20	Rippable	---	---
Rock outcrop.											
NaB, NbC: Nakai	B	None	---	---	>6.0	---	---	>60	---	---	---

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft			In		In	
NCF*, NDG*:											
Namon	C	None	---	---	>6.0	---	---	40-60	Hard	---	---
Rock outcrop.											
NkD----------	A	Occasional	Brief	Jul-Aug	>6.0	---	---	>60	---	---	---
Nepalto											
NnD----------	B	None	---	---	>6.0	---	---	>60	---	---	---
Neskahi											
NOC*:											
Neskahi----------	B	None	---	---	>6.0	---	---	>60	---	---	---
Oljeto----------	A	None	---	---	>6.0	---	---	>60	---	---	---
OJD*:											
Oljeto----------	A	None	---	---	>6.0	---	---	>60	---	---	---
Sheppard---------	A	None	---	---	>6.0	---	---	>60	---	---	---
PcD----------	D	None	---	---	>6.0	---	---	12-20	Hard	---	---
Pickrell											
PrE*, PsE*:											
Piute----------	D	None	---	---	>6.0	---	---	7-10	Hard	---	---
Rock outcrop.											
PY*.											
Playas											
RaE----------	C	None	---	---	>6.0	---	---	30-40	Hard	---	---
Raplee											
RED*:											
Redbank----------	B	None	---	---	>6.0	---	---	>60	---	---	---
Shedado----------	B	None	---	---	>6.0	---	---	24-40	Hard	---	---
RH*.											
Riverwash.											
RO*.											
Rock outcrop.											
RRG*:											
Rock outcrop.											
Lithic Torriorthents.											
RSG*:											
Rock outcrop.											
Moenkopie--------	D	None	---	---	>6.0	---	---	5-20	Rippable	---	---
SaE----------	B	None	---	---	>6.0	---	---	24-40	Hard	---	---
Shedado											
ShD, ShE, SkE-----	A	None	---	---	>6.0	---	---	>60	---	---	---
Sheppard											
SME*:											
Sheppard----------	A	None	---	---	>6.0	---	---	>60	---	---	---

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft			In		In	
SME*: Rock outcrop.											
SnB, SoB---------- Sogzie	B	None--------	---	---	>6.0	---	---	>60	---	---	---
SSD*: Sogzie----------	B	None--------	---	---	>6.0	---	---	>60	---	---	---
Sheppard---------	A	None--------	---	---	>6.0	---	---	>60	---	---	---
TeA---------- Tezuma	C	None--------	---	---	>6.0	---	---	>60	---	---	---
TnC---------- Tohona	C	None--------	---	---	>6.0	---	---	20-40	Rippable	---	---
ToB---------- Tohona variant	B	None--------	---	---	>6.0	---	---	20-40	Hard	---	---
TrD---------- Trail	A	Rare--------	---	---	>6.0	---	---	>60	---	---	---
UHG*: Ustollic Haplargids.											
Ustic Torriorthents.											
Rock outcrop.											
WhB, WkB---------- Whit	B	None--------	---	---	>6.0	---	---	>60	---	---	---

* See map unit description for the composition and behavior of the map unit.

TABLE 14.--LABORATORY ANALYSIS OF SELECTED SOILS

[Analysis made by Bureau of Indian Affairs, Water and Material Testing Laboratory, Gallup, New Mexico. Dash in a column indicates no determinations were made]

Soil Name	Horizon	Depth	Hydrometer Method			Water Control at 15 Atmos.	Saturated Paste	1-5 H_2O	Organic Matter	Electrical Conductivity	Calcium Carbonate Equivalent
			Sand	Silt	Clay						
		In.	%	%	%	%	pH	pH	%	mmhos/per cm. 25°	%
Anasazi very stony very fine sandy loam	A1	0-4	72	12	16	6.4	7.6	--	0.6	0.4	1
	B2	4-10	72	18	10	8.6	7.6	--	1.2	0.5	3
	C1ca	10-17	66	16	18	8.1	7.8	--	0.8	0.4	37
	C2ca	17-24	72	14	14	6.6	8.1	--	0.7	0.5	41
	R	24	--	--	--	--	--	--	--	--	--
Aneth loamy fine sand	C1	0-7	84	8	8	--	7.8	8.8	--	0.7	0
	C2	7-26	82	10	8	--	7.9	8.7	--	0.4	0
	C3	26-36	76	11	13	--	7.8	8.7	--	0.4	10
	C4	36-60	85	8	7	--	7.9	8.9	--	0.5	9
Begay loamy fine sand	A1	0-3	78	20	2	3.0	7.9	--	1.3	0.6	1
	B2	3-16	74	16	10	4.4	7.8	--	0.5	0.4	1
	C1ca	16-28	58	30	12	5.4	7.9	--	0.3	0.4	3
	C2ca	28-42	64	28	8	4.6	8.0	--	0.2	0.4	3
	C3	42-60	68	24	8	3.8	8.1	--	0.1	0.5	2
Deleco loamy fine sand	A1	0-3	86	7	7	--	7.8	8.9	0.6	0.5	--
	C1ca	3-7	78	14	8	--	7.6	8.8	0.8	0.5	45
	C2ca	7-10	74	16	10	--	7.8	8.6	--	0.5	41
	C3cam	10-14	--	--	--	--	--	--	--	--	--
	C4ca	14-42	--	--	--	--	--	--	--	--	--
	C5	42-54	78	10	12	--	8.2	9.0	--	1.1	--
Gotho clay	C1	0-4	44	16	40	--	8.2	9.2	0.5	1.6	--
	C2	4-16	42	14	44	--	7.8	8.9	0.5	4.0	--
	C3	16-60	62	14	24	--	7.8	9.1	--	2.6	--
Hoskinnini gravelly fine sandy loam	A1	0-1	86	10	4	2.6	8.2	--	0.3	0.5	18
	B21t	1-4	78	8	14	4.3	8.0	--	0.3	0.3	19
	B22t	4-8	74	14	12	5.1	7.9	--	0.6	0.4	19
	Cca	8-12	68	22	10	6.7	7.8	--	1.2	0.5	39
	R	12	--	--	--	--	--	--	--	--	--
Moenkopie sandy loam	A1	0-6	48	38	14	4.0	8.0	--	0.2	0.4	24
	C	6-15	32	54	14	3.1	7.8	--	0.1	0.9	32
	R	--	--	--	--	--	--	--	--	--	--
Monue loamy fine sand	A1	0-13	82	14	4	2.2	8.3	--	0.2	0.6	6
	B2	13-24	72	20	8	3.8	8.2	--	0.1	0.4	6
	C1ca	24-35	52	30	18	5.1	8.4	--	0.2	0.5	10
	C2	35-46	64	25	11	3.7	8.4	--	0.1	0.6	4
	R	--	--	--	--	--	--	--	--	--	--
Mota loamy very fine sand	A1	0-6	87	7	6	--	8.2	8.9	0.2	0.5	--
	C1ca	6-23	72	16	12	--	8.0	8.9	--	0.3	24
	C2	23-60	82	10	8	--	8.3	9.1	--	0.4	16
Nakai loamy fine sand	A1	0-5	86	8	6	--	7.9	9.0	0.2	1.1	--
	AC	5-18	85	8	7	--	7.4	8.9	0.2	0.4	--
	C1ca	18-26	79	8	13	--	8.1	8.9	--	0.4	--
	C2ca	26-34	62	21	17	--	8.1	9.1	--	0.8	--
	C3	34-60	84	8	8	--	8.2	8.9	--	0.4	--
Namon very cobbly very fine sandy loam	A1	0-5	66	30	4	4.9	7.7	--	3.2	0.7	1
	A2	5-21	62	34	4	3.1	7.1	--	1.3	0.7	1
	B1	21-33	74	20	6	2.9	7.0	--	0.6	0.5	1
	B2t	33-48	72	18	10	3.7	6.7	--	0.7	0.7	1
Nepalto very fine sandy loam	A1	0-12	80	16	4	2.3	8.1	--	0.2	0.5	7
	C1	12-31	88	8	4	1.7	8.4	--	0.1	0.5	12
	C2	31-60	86	10	4	2.2	8.5	--	0.1	0.9	12

TABLE 14.--LABORATORY ANALYSIS OF SELECTED SOILS--Continued

Soil Name	Horizon	Depth	Hydrometer Method			Water Control at 15 Atmos.	Saturated Paste	1-5 H_2O	Organic Matter	Electrical Conductivity	Calcium Carbonate Equivalent
			Sand	Silt	Clay						
		In.	%	%	%	%	pH	pH	%	mmhos/per cm. 25°	%
Neskahi loamy fine sand	A1	0-6	82	14	4	2.0	8.4	--	0.2	0.6	1
	C1	6-16	72	20	8	3.4	8.2	--	0.2	0.6	4
	C2	16-25	52	30	18	6.1	8.2	--	0.3	0.5	10
	C3	25-35	64	25	11	4.1	8.7	--	0.2	0.6	8
	C4	35-60	72	21	7	3.2	8.3	--	0.1	6.8	7
Oljeto loamy fine sand	A1	0-20	76	21	3	2.1	8.4	--	0.1	0.5	11
	C1ca	20-40	80	15	5	1.8	8.1	--	0.2	0.9	20
	C2	40-60	86	12	2	1.4	8.2	--	0.1	1.2	15
Pickrell loamy fine sand	A11	0-2	92	4	4	1.7	7.7	--	0.7	0.4	6
	A12	2-5	82	10	8	3.8	8.0	--	0.6	0.4	10
	B2	5-12	80	16	4	3.3	8.1	--	0.4	0.4	8
	C1ca	12-18	78	14	8	6.0	8.1	--	0.6	0.4	27
	R	18	--	--	--	--	--	--	--	--	--
Piute loamy fine sand	C1	0-9	88	4	8	4.7	8.0	--	0.4	0.5	26
Raplee very fine sandy loam	C1	0-4	58	34	8	12.7	8.1	--	0.2	2.7	5
	C2	4-22	54	38	8	10.0	8.1	--	0.2	3.0	7
	C3	22-36	--	--	--	--	--	--	--	--	--
Redbank very fine sandy loam	A1	0-8	72	16	12	4.9	7.5	--	0.6	0.4	1
	C1	8-28	80	10	10	4.4	7.9	--	0.3	0.4	3
	C2	28-42	84	6	10	4.2	8.1	--	0.2	0.4	3
	IIC3ca	42-60	72	10	18	6.2	8.3	--	0.3	1.5	54
Shedado loamy very fine sand	A1	0-7	86	8	6	1.9	--	--	0.5	0.4	8
	C1	7-15	84	8	8	2.5	--	--	0.3	0.3	7
	C2	15-24	80	8	12	4.2	--	--	0.3	0.5	8
	C3	24-35	--	--	--	--	--	--	--	--	--
	R	35	--	--	--	--	--	--	--	--	--
Sheppard fine sand	C1	0-12	94	2	4	--	8.2	--	0.1	0.3	--
	C2	12-60	85	11	4	--	8.2	--	--	0.3	--
Sogzie very fine sandy loam	A1	0-5	77	14	9	--	8.0	8.8	0.2	0.4	--
	B21	5-12	72	18	10	--	7.9	8.8	0.3	0.3	--
	B22	12-21	69	20	11	--	8.0	8.8	--	0.4	--
	C1	21-38	73	14	13	--	8.0	8.8	--	0.4	--
	C2ca	38-80	72	13	15	--	8.0	8.7	--	0.3	22
Tezuma silt loam	A1	0-4	17	59	24	--	8.8	9.8	1.6	6.4	--
	C1	4-18	11	67	22	--	8.1	9.0	1.5	8.0	--
	C2	18-60	5	41	54	--	7.9	8.5	--	11.2	--
Tohona sandy clay loam	A1	0-5	53	23	24	--	8.0	9.2	0.5	1.1	--
	B21	5-20	46	23	31	--	8.3	9.5	0.4	2.8	--
	B22cs	20-34	48	19	33	--	8.1	8.3	--	13.3	--
	Cr	34-52	--	--	--	--	--	--	--	--	--
Tohona variant, very fine sandy loam	A1	0-6	59	22	19	--	8.1	8.9	0.4	0.6	--
	B2	6-18	53	26	21	--	7.9	9.0	--	0.5	--
	C1ca	18-34	55	25	20	--	8.0	8.3	--	14.5	18
	R	34	--	--	--	--	--	--	--	--	--
Trail loamy sand	C1	0-12	88	6	6	2.2	8.3	--	0.1	0.5	10
	C2	12-25	84	10	6	2.1	8.2	--	0.1	0.4	9
	C3	25-37	82	12	6	2.2	7.9	--	0.2	0.4	6
	C4	37-60	80	10	10	3.2	8.2	--	0.1	0.6	11
Whit very fine sandy loam	A1	0-4	62	23	15	--	7.9	8.7	0.5	0.4	--
	B21	4-16	64	20	16	--	7.9	8.8	0.3	0.3	--
	B22	16-30	59	23	18	--	8.0	8.8	--	0.5	--
	C1ca	30-38	58	24	18	--	8.1	8.9	--	0.6	12.8
	C2ca	38-54	64	14	22	--	8.5	9.3	--	1.1	39.9
	C3ca	54-66	65	14	21	--	8.4	9.2	--	1.8	50.5

TABLE 15.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Anasazi	Coarse-loamy, mixed, mesic Ustollic Calciorthids
Aneth	Sandy, mixed, mesic Typic Torriorthents
Begay	Coarse-loamy, mixed, mesic Ustollic Camborthids
Deleco	Loamy-skeletal, carbonatic, mesic, shallow Typic Paleorthids
Gotho	Fine-loamy, mixed (calcareous), mesic Typic Torriorthents
Hoskinnini	Loamy, mixed, mesic Lithic Haplargids
Mespun	Mixed, mesic Ustic Torripsamments
Moenkopie	Loamy, mixed (calcareous), mesic Lithic Torriorthents
Moepitz	Coarse-loamy, mixed (calcareous), mesic Typic Torriorthents
Monue	Coarse-loamy, mixed, mesic Typic Camborthids
Mota	Coarse-silty, mixed, mesic Typic Calciorthids
Nakai	Coarse-loamy, mixed, mesic Typic Calciorthids
Namon	Loamy-skeletal, mixed Mollic Cryoboralfs
Nepalto	Sandy-skeletal, mixed (calcareous), mesic Typic Torrifluvents
Neskahi	Coarse-loamy, mixed (calcareous), mesic Typic Torrifluvents
Oljeto	Sandy-skeletal, mixed, mesic Typic Calciorthids
Pickrell	Sandy, mixed, mesic Lithic Calciorthids
Piute	Sandy, mixed, mesic Lithic Torriorthents
Raplee	Coarse-loamy, gypsic, mesic Typic Torriorthents
Redbank	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Shedado	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
Sheppard	Mixed, mesic Typic Torripsamments
Sogzie	Coarse-silty, mixed, mesic Typic Calciorthids
Tezuma	Fine-silty over clayey, mixed (calcareous), mesic Typic Torrifluvents
Tohona	Fine-silty, mixed, mesic Cambic Gypsiorthids
Tohona variant	Fine-silty, mixed, mesic Typic Calciorthids
Trail	Sandy, mixed, mesic Typic Torrifluvents
Whit	Fine-silty, mixed, mesic Typic Calciorthids

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS

UTAH AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

SAN JUAN COUNTY, UTAH
(NAVAJO INDIAN RESERVATION)

Scale 1: 506,880
1 0 1 2 3 4 5 6 7 Miles

Compiled 1979

N

MAP UNITS

1 — Rock outcrop-Lithic Torriorthents-Badland: Shallow and very shallow, well drained soils that formed on uplands and mesas in residuum, colluvium, and alluvium derived from mixed sedimentary rock; also Rock outcrop and Badland

2 — Tohona-Raplee: Moderately deep, well drained soils that formed on uplands, mesas, and pediments in residuum and alluvium derived from gypsiferous sedimentary rock

3 — Moenkopie-Hoskininni-Rock outcrop: Shallow and very shallow, well drained soils that formed on upland pediments and in broad valleys in residuum and alluvium derived from sedimentary rock; also Rock outcrop

4 — Piute-Pickrell-Rock outcrop: Shallow and very shallow, well drained soils that formed on uplands, benches, and mesas in eolian deposits and residuum derived from sandstone; also Rock outcrop

5 — Nakai-Deleco-Monue: Shallow to deep, well drained soils that formed on terraces, benches, and mesas in alluvium and eolian deposits derived from sedimentary rock

6 — Mota-Neskahi-Oljeto: Very deep, well drained and somewhat excessively drained soils that formed in valleys and on mesas, upland benches, and fans in eolian deposits and alluvium derived from sandstone

7 — Aneth-Sheppard: Very deep and deep, somewhat excessively drained soils that formed on uplands and valley bottoms in eolian deposits and alluvium derived from sandstone

8 — Monue-Moepitz-Sheppard: Moderately deep and deep, well drained and somewhat excessively drained soils that formed on uplands and valley bottoms in eolian deposits and alluvium derived from sandstone

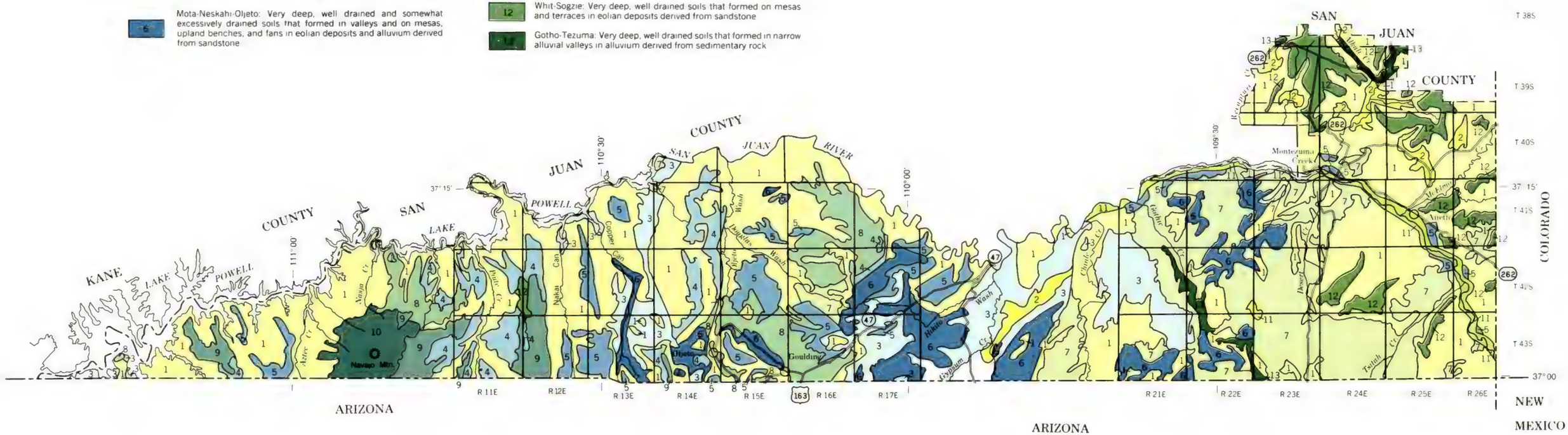
9 — Shedado-Begay-Anasazi: Moderately deep and very deep, well drained soils that formed on mesas, uplands, and pediments in eolian deposits and residuum derived from sandstone

10 — Namon-Rock outcrop-Ustollic Haplargids: Moderately deep and deep, well drained soils that formed on plateaus and mountain slopes in residuum and colluvium derived from sandstone and shale; also Rock outcrop

11 — Aquic Ustifluvents-Typic Fluvaquents: Very deep, somewhat poorly drained to very poorly drained soils that formed on valley bottoms in alluvium derived from sedimentary rock

12 — Whit-Sogzie: Very deep, well drained soils that formed on mesas and terraces in eolian deposits derived from sandstone

13 — Gotho-Tezuma: Very deep, well drained soils that formed in narrow alluvial valleys in alluvium derived from sedimentary rock



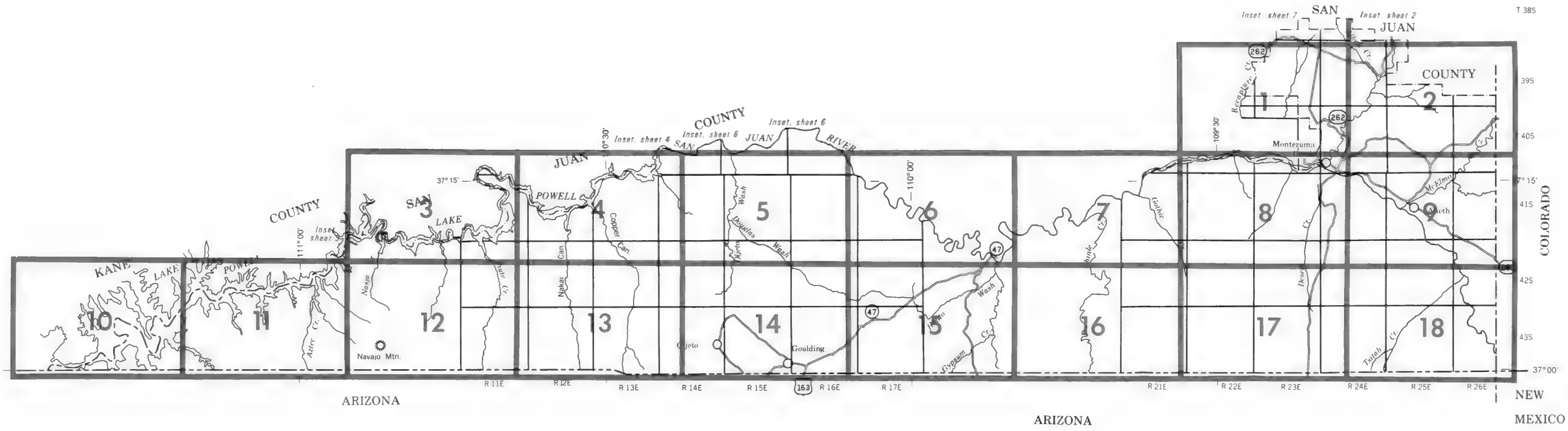
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Original text from each individual map sheet read:
This map is compiled on 1974 and 1975 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

SAN JUAN COUNTY, UTAH
(NAVAJO INDIAN RESERVATION)

Scale 1:506,880
1 0 1 2 3 4 5 6 7 Miles



CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

SOIL LEGEND

SYMBOL	NAME
AaC	Anasazi very stony very fine sandy loam, 3 to 10 percent slopes
AaF	Anasazi very stony very fine sandy loam, 10 to 25 percent slopes
AmB	Aneth loamy fine sand, 1 to 8 percent slopes
AnA	Aneth loamy fine sand, moderately alkali, 0 to 3 percent slopes
AsA	Aneth sandy clay loam, 0 to 3 percent slopes
AtA	Aneth sandy clay loam, strongly alkali, 0 to 3 percent slopes
AUC	Aneth-Sheppard association, rolling*
AV	Aquic Ustifluvents-Typic Fluvaquents association, gently sloping*
BA	Badland*
BD	Badland-Typic Torrifluvents association, steep*
BbD	Begay loamy fine sand, 3 to 8 percent slopes
DeE	Deleco loamy fine sand, 12 to 55 percent slopes
DMD	Deleco-Monue association, sloping*
DND	Deleco-Nakai-Rock outcrop association, sloping*
GoB	Gotho fine sandy loam, 1 to 8 percent slopes
GtA	Gotho soils, 0 to 3 percent slopes
HaD	Hoskinnini very fine sandy loam, very shallow, 2 to 5 percent slopes
HmD	Hoskinnini-Rock outcrop complex, 2 to 8 percent slopes
LAG	Lithic Torriorthents Typic Torriorthents-Rock outcrop association steep*
LLG	Lithic Torriorthents-Rock outcrop, limestone complex steep*
MaE	Mespun fine sand, 2 to 10 percent slopes
MbD	Moenkopie sandy loam, 3 to 8 percent slopes
McF	Moenkopie-Rock outcrop complex, 8 to 25 percent slopes
MeD	Moepitz very fine sand, 3 to 8 percent slopes
MFD	Moepitz-Monue association, gently sloping*
MhD	Monue-Sheppard complex, 1 to 12 percent slopes
MoB	Mota loamy fine sand, 1 to 8 percent slopes
MRE	Mota Moenkopie-Rock outcrop association, sloping*
NaB	Nakai loamy fine sand, 1 to 8 percent slopes
NbC	Nakai very fine sandy loam, 2 to 6 percent slopes
NCF	Namon Rock outcrop complex, 3 to 25 percent slopes*
NDG	Namon-Rock outcrop complex, low rainfall, 25 to 55 percent slopes
NkD	Nepalto very fine sandy loam, 2 to 8 percent slopes
NnD	Neskahi fine sandy loam, 2 to 6 percent slopes
NOC	Neskahi Ojeto association, sloping*
OJD	Ojeto-Sheppard association, sloping*
PcD	Pickrell loamy fine sand, 2 to 6 percent slopes
PrE	Piute-Rock outcrop complex, 3 to 25 percent slopes
PsE	Piute-Rock outcrop, high rainfall, complex, 3 to 25 percent slopes
PY	Playas*
RaE	Raplee very fine sandy loam, 2 to 12 percent slopes
RED	Redbank-Shedado association, sloping*
RH	Riverwash*
RO	Rock outcrop*
RRG	Rock outcrop, sandstone-Lithic Torriorthents association, steep*
RSG	Rock outcrop Moenkopie association, steep*
SaE	Shedado loamy fine sand, 1 to 8 percent slopes
ShD	Sheppard fine sand, hummocky
ShE	Sheppard fine sand, rolling
SkE	Sheppard fine sand, high rainfall, hummocky
SME	Sheppard-Rock outcrop association, hummocky*
SnB	Sogzie very fine sandy loam, 1 to 8 percent slopes
SoB	Sogzie very fine sandy loam, low rainfall, 1 to 8 percent slopes
SSD	Sogzie-Sheppard association, sloping*
TeA	Tezuma silt loam
TnC	Tohona sandy clay loam, 1 to 12 percent slopes
ToB	Tohona variant, very fine sandy loam, 1 to 8 percent slopes
TrD	Trail loamy sand, 1 to 8 percent slopes
UHG	Ustollic Haplargids-Ustic Torriorthents Rock outcrop association, steep*
WhB	Whit very fine sandy loam, 1 to 8 percent slopes
WkB	Whit very fine sandy loam, low rainfall, 1 to 8 percent slopes*

* Broadly defined units

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (70)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; W)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; W)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (cA; FoB)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Borrow pit (B.P.)
- Glacial till

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 1

2580 000 FEET

R. 22 E. | R. 23 E.

R. 23 E. | R. 24 E. (Joins inset, sheet 7)

T. 40 S | T. 39 S

2280 000 FEET

(Joins sheet 8)

2 640 000 FEET

N

Scale 1:63360

5 Miles

25000 Feet

20000

15000

(Joins sheet 2)

5000

NAVAJO INDIAN RESERVATION

MC CRACKEN MESA

BOUNDARY SURVEY

LIMIT OF RESERVATION

Horse Canyon

Soil Creek

Recapture

McCracken

Canyon

Ruins

Radio Tower

Rock Canyon

Straw Spring

Black Creek

Bucket Gray Canyon

Montezuma

ANETH OIL FIELD

SAN JUAN RIVER

WhB WkB TnC BD BA GoB NaB AmB

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 2

N

R. 24 E. | R. 25 E. | R. 25 E. | R. 26 E.

2 720 000 FEET

T. 39 S. | T. 38 S.

T. 40 S | T. 39 S

Scale 1:63360

Miles

25000 Feet

20000

15000

10000

5000

0

(Joins inset)

(Joins sheet 1)

(Joins sheet 9)

(Joins inset, sheet 7)

(Joins sheet 2)

2 668 000 FEET

2 648 000 FEET

10 000 AND 20 000-FOOT GRID TICKS

Alkali Canyon

Alkali Creek

Black Steer Canyon

Hatch Trading Post

Navajo Creek

Canyon

Wickiup Canyon

Little Ruin Canyon

Black Rock Canyon

Montezuma Creek

Allen Canyon

West Fork Allen Canyon

McElmo Creek

Pussywillow Spring

NAVAJO INDIAN RESERVATION

MC CRACKEN MESA

CAJON MESA

HOVENWEEP NATIONAL MONUMENT

LIMIT

SOIL

SURVEY

UTAH

COLORADO

SAN JUAN COUNTY

MONTEZUMA COUNTY

BD

BA

TeA

TnC

WhB

WkB

AmB

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 3

3

N

2 180 000 FEET

2 156 000 FEET

137 000 FEET

176 000 FEET

2 168 000 FEET

(Joins sheet 11)

(Joins sheet 3)

(Joins sheet 4)

(Joins inset)

(Joins sheet 12)

12 000 AND 16 000-FOOT GRID TICKS

COLORADO RIVER

GLEN CANYON

KANE COUNTY

SAN JUAN COUNTY

UINT

NAVAJO

INDIAN

RESERVATION

LAKE

POWELL

RIVER

SAN JUAN

SURVEY

BOUNDARY

Great Bend

Deep

Trail Canyon

Rock Canyon

Piute Creek

Navajo Creek

RRG

LAG

MeD

PrE

PsE

T. 40 S.

T. 41 S.

T. 42 S.

R. 10 E.

R. 11 E.

5 Miles

25 000 Feet

20000

15 000

5000

0

Scale 1:63360

4

N

Scale 1:63 360

R. 14 E.

2 330 000 FEET

2 320 000 FEET

229 000 FEET

235 000 FEET

T. 40 S.

T. 41 S.

SAN JUAN RIVER

Clay Hills Crossing

(Joins sheet 4) | (Joins sheet 5)

10 000 AND 16 000 FOOT GRID TICKS

(Joins inset)

(Joins sheet 3)

(Joins sheet 5)

RIVER

BOUNDARY SURVEY

RESERVATION

INDIAN RESERVATION

NAVAJO INDIAN RESERVATION

MONITOR BUTTE

MESA

Rockhouse Gulch

Neskahi

Nakai Canyon

Copper Canyon

Farms Wash

Piute Farms

MONUMENT VALLEY

R. 11 E. | R. 12 E. (Joins sheet 13)

R. 12 E. | R. 13 E.

R. 13 E. | R. 14 E.

T. 42 S.

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 5

(Joins inset B, sheet 6) | 2 340 000 FEET | R. 14 E. | R. 15 E. | R. 15 E. | R. 16 E. | (Joins inset A, sheet 6)

T. 41 S. | T. 40 S. | 220 000 FEET

(Joins sheet 4)

T. 42 S. | T. 41 S.

(Joins sheet 14) | 2 400 000 FEET

5

N

5 Miles

25 000 Feet

20000

15000

5000

0

(Joins sheet 6)

Scale 1:63360

1 INCH EQUALS 5000 FEET

SAN JUAN RIVER

LIMIT OF SOIL SURVEY

MONUMENT

Oljeto

Water Wash

Rockhouse Valley

Tank Canyon

DOUGLAS MESA

NAVAJO INDIAN RESERVATION

RRG

DMD

SSD

MhD

ShD

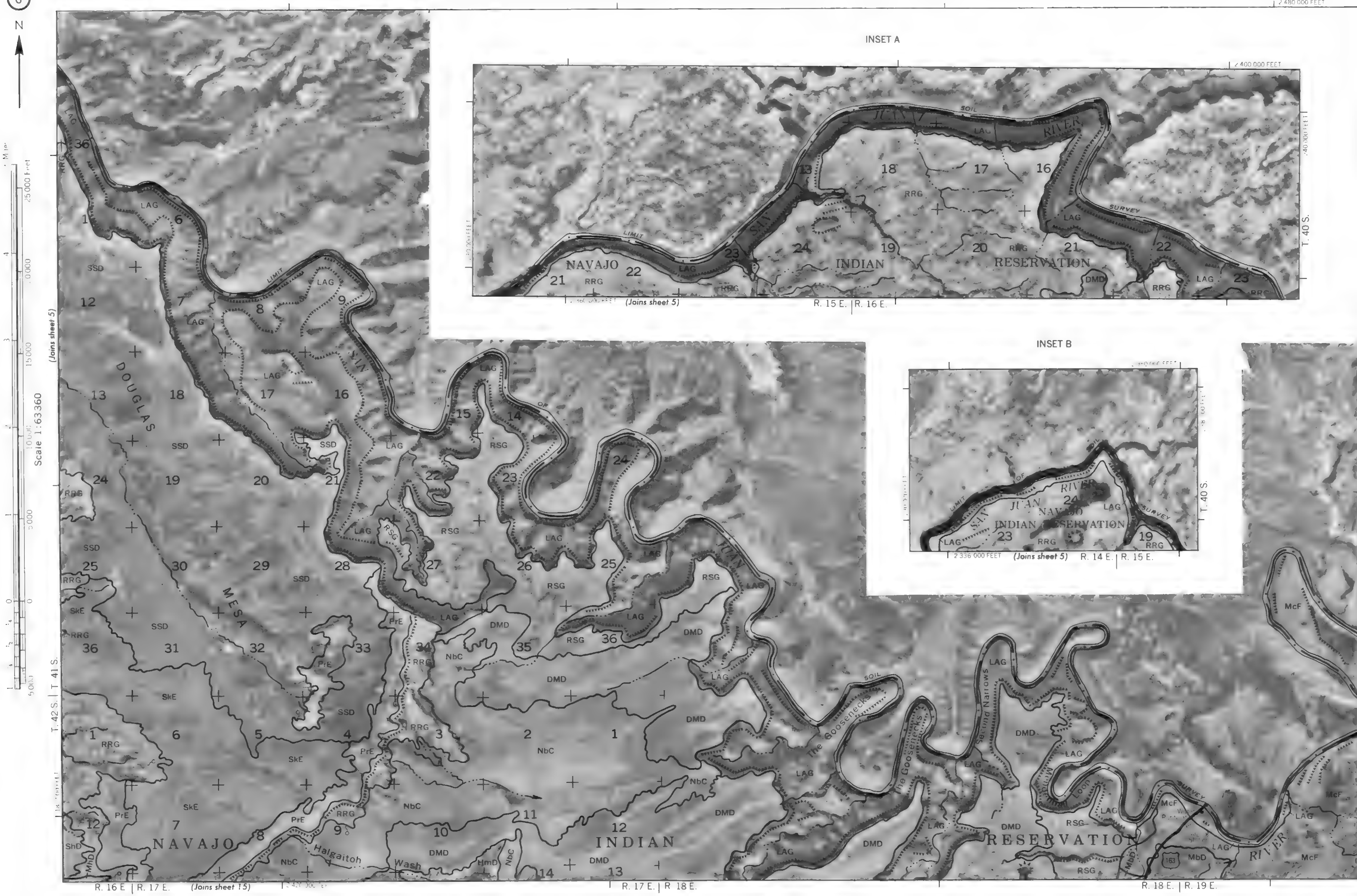
SkE

PrE

PcD

LAG

HmD


N
Scale 1:63 360
INSET A
INSET B
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 15)
DOUGLAS
MESA
NAVAJO
INDIAN
RESERVATION
SAN JUAN RIVER
SOIL SURVEY LIMIT
The Goosenecks
Second Narrows
Halgaitoh Wash
LAG
SSD
RRG
RSG
DMD
NbC
SkE
PrE
ShD
MhD
HmD
McF
MbD
163
T. 40 S.
T. 41 S.
T. 42 S.
R. 14 E.
R. 15 E.
R. 16 E.
R. 17 E.
R. 18 E.
R. 19 E.

7

N

Scale 1:63360

5 Miles

4

3

2

1

0

5000 0 5000 15000 20000 25000 Feet

(Joins sheet 8)

(Joins sheet 6)

(Joins inset, sheet 2)

(Joins sheet 1)

(Joins sheet 16)

2 620 000 FEET

2 640 000 FEET

2 560 000 FEET

220 000 FEET

296 000 FEET

286 000 FEET

180 000 FEET

39 S. | T. 38 S.

T. 42 S. | T. 41 S.

R. 23 E. | R. 24 E.

R. 20 E. | R. 21 E.

NAVAJO INDIAN RESERVATION

CASA DEL ECO MESA

White Rock Point

Window Rock

Window Rock Spring

Gothic Canyon

Alkali Canyon

Tsa Creek

Soda Basin

Soda Spring

Mule Ear

COMB RIDGE

NOKAITO BENCH

Chinle Creek

Raplee Ridge

Ute Canyon

Ute Spring

TOHONADLA OIL FIELD

Airstrip

SAN JUAN RIVER

SAN JUAN CANYON

SURVEY

SOIL BOUNDARY

RESERVATION BOUNDARY

LIMIT OF NAVAJO INDIAN RESERVATION

CCC Corral

AV

BA

DeE

GtA

LAG

LLG

MbD

McF

MoB

MRE

RO

RRG

RaE

ShD

ShE

TnC

WhB

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 8

8

N

Scale 1:63360

R 21 E | R 22 E (Joins sheet 1) | R 22 E | R 23 E | R 23 E | R 24 E

T 41 S. | T 40 S.

T. 42 S. | T. 41 S.

(Joins sheet 7)

(Joins sheet 9)

(Joins sheet 17)

180 000 FEET

2 580 000 FEET

220 000 FEET

NAVAJO INDIAN RESERVATION

ECO MESA

CASA DEL

Ute Canyon

Gray Point

Hogan Mesa

Flat Top Mountain

White Mesa Mountain

Montezuma Creek

Tsinahee Spring

Little Water Spring

Salt Water Spring

Red Lake Village

White Rock Curve Village

Blue Hogan Wash

Small Salt Creek

Desert Creek

Sethozie Wash

Lone Cedar Wash

White Mesa Valley

TOHONADLA OIL FIELD

ANETH OIL FIELD

SURVEY LIMIT OF SOIL

SAN JUAN RIVER

AV AmB BA BD DeE MoB SME ShD ShE AUC AsA GtA SnB NaB

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 9

9

N

R. 24 E. | R. 25 E. | R. 25 E. | R. 26 E.

(Joins sheet 2)

T. 41 S. | T. 40 S.

T. 42 S. | T. 41 S.

(Joins sheet 8)

(Joins sheet 18)

2 660 000 FEET

2 720 000 FEET

220 000 FEET

180 000 FEET

NAVAJO INDIAN RESERVATION

UTAH COLORADO

SAN JUAN COUNTY MONTEZUMA COUNTY

Scale 1:63360

1 inch = 5 Miles

Airstrip

Continental Airstrip

Continental Camp

Cliff Dwellings

CEMETERY

West Fork Allen Canyon

Allen Canyon

Black Rock Point

Sandy Spring

Tow Gray Spring

Tow Gray Hill

Tow Gray Creek

OIL FIELD

SAN JUAN RIVER

Aneth

ANETH POINT

McElmo Creek

McElmo Trail

Mail Trail

Lone Mountain

Clay Hill

Clay Hill Canyon

Sahgzie Canyon

Sahgzie Creek

MESA

WHITE MESA

Lone Mountain

Mountain

Peters Nipple

Rockwell Spring

Rockwell Flat

Rough Canyon

Marble Wash

AmB

AUC

BA

BD

NaB

SnB

ToB

TnC

WhB

WkB

AV

SAN JUAN COUNTY, UTAH. NAVAJO INDIAN RESERVATION — SHEET NUMBER 10

10

N

R. 4 E. | R. 5 E

R. 5 E | R. 6 E

Scale 1:63360

LAKE POWELL

KANE COUNTY

SAN JUAN COUNTY

GLEN CANYON

NAVAJO INDIAN RESERVATION

COLORADO RIVER

SAN JUAN COUNTY UTAH
COCONINO COUNTY ARIZONA

HmD

MeD

LAG

(Joins sheet 11)

(Joins inset, sheet 3)

(Joins sheet 10)

(Joins sheet 12)

11

N

Scale 1:63 360

5 Miles

KANE COUNTY

SAN JUAN COUNTY

COCONINO COUNTY

ARIZONA

UTAH

LAKE POWELL

GLEN CANYON

COLORADO RIVER

NAVAJO INDIAN RESERVATION

RAINBOW PLATEAU

CUMMINGS MESA

Rainbow Bridge NATIONAL MONUMENT

Forbidden Canyon

Oak Canyon

Dome Canyon

Cliff Canyon

Aztec Creek

Water

RRG

LAG

DND

BbD

PrE

SaE

UHG

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 12

12

N

Scale 1:63360

Miles

R. 10 E. | R. 11 E.

T. 43 S. | T. 42 S.

(Joins sheet 3)

(Joins sheet 11)

(Joins sheet 13)

Hawkeye Natural Bridge

Rainbow Canyon

Owl Bridge Canyon

Navajo Begay Plateau

Navajo Mountain School

War God Spring

Jackrabbit Canyon

Deep Canyon

Trail Canyon

Bald Rock Canyon

Nash Creek

Oak Creek

Bridge Creek

Horse Canyon

Piute Creek

NAVAJO INDIAN RESERVATION

NAVAJO MOUNTAIN

COCONINO COUNTY ARIZONA | SAN JUAN COUNTY UTAH | NAVAJO COUNTY ARIZONA

2 180 000 FEET

SAN JUAN COUNTY, UTAH. NAVAJO INDIAN RESERVATION — SHEET NUMBER 13

13

N

R. 11 E. | R. 12 E. | R. 12 E. | R. 13 E. | (Joins sheet 4) R. 13 E. | R. 14 E.

T. 43 S. | T. 42 S.

(Joins sheet 12)

(Joins sheet 14)

2 260 000 FEET

160 000 FEET

NAVAJO INDIAN RESERVATION

Neskahi

PIUTE MESA

Nakai

MANS MESA

NAKAI MESA

Chaco Wash

Copper Canyon

Jacobs Monument

Copper East Creek

Copper West Creek

Tse-dahsecani

Plute Farms Wash

HOSKININAI MESA

Pickett Mesa

Thumb Rock

SAN JUAN COUNTY UTAH

NAVAJO COUNTY ARIZONA

Scale 1:63360

5 Miles

25 000 Feet

20000

15000

5000

0

5000

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 14

14

N

(Joins sheet 5)

R. 14 E. | R. 15 E.

R. 15 E. | R. 16 E

2 400 000 FEET

Organ Rock

Train Rock

Cedar Spring

MONUMENT

Rock

Wash

Mitchell

Wash

Wash

Wash

NAVAJO INDIAN RESERVATION

Holiday Mesa

OLJETO MESA

Oljeto

Oljeto

Butte

Monument

VALLEY

Eagle Rock

Setting Hen

Eagle Mesa

Sentinel Mesa

Horse Trail Canyon

Gouldings Trading Post

Rock Door Mesa

Navajo Spring

The Gap

SAN JUAN COUNTY, UTAH

NAVAJO COUNTY, ARIZONA

(Joins sheet 13)

(Joins sheet 15)

T. 43 S. | T. 42 S.

Scale 1:63 360

5 Miles

25 000 Feet

20000

15000

5000

0

40 000 FEET

5000

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 15

R. 16 E. | R. 17 E. | R. 17 E. | R. 18 E.

2 420 000 FEET

(Joins sheet 6)

T. 43 S. | T. 42 S.

160 000 FEET

(Joins sheet 14)

(Joins sheet 16)

140 000 FEET

2 480 000 FEET

NAVAJO INDIAN RESERVATION

MONUMENT VALLEY

Alhambra Rock

Mexican Hat Post Office

Tailing Pond

Landing Strip

Douglas Wash

Halgaitoh Wash

Halgaitoh Spring

Eagle Rock

Monument Pass

Saddleback

Kingsmills Throne

Stagecoach

Bear and Rabbit

Coyote Rock

Big Indian

Sentinel Mesa

Conical Butte

Gypsum Creek

Cane Valley Wash

NAVAJO COUNTY ARIZONA | SAN JUAN COUNTY UTAH | APACHE COUNTY ARIZONA

15

N

5 Miles

25000 Feet

20000

15000

10000

5000

Scale 1:63360


(Joins sheet 7)
R. 20 E.
R. 21 E.
2 560 000 FEET
T. 43 S.
T. 42 S.
(Joins sheet 15)
(Joins sheet 17)
Scale 1:63 360
5 Miles
25 000 Feet
20000
15000
10000
5000
140 000 FEET
2 500 000 FEET
Chinle Creek
Raplee Ridge
VALLEY
RIDGE
COMB
NOKAITO
BENCH
MONUMENT
NAVAJO
INDIAN
RESERVATION
Cliff Dwellings
Moses Rock
Poncho House
Sand Dunes
Garnet Ridge
SAN JUAN COUNTY UTAH
APACHE COUNTY ARIZONA
McF
LLG
RaE
MbD
NnD
BA
AnA
LAG
RO
RRG
ShD
MRE
GtA
ShE
MoB
BD

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 17

17

N

R. 21 E. | R. 22 E. | R. 23 E. | R. 24 E.

2 580 000 FEET

T. 43 S. | T. 42 S.

160 000 FEET

140 000 FEET

2 640 000 FEET

(Joins sheet 8)

(Joins sheet 16)

(Joins sheet 18)

Sand Spring

NORTH BOUNDARY BUTTE OIL FIELD

Airstrip

Red Lake intermittent

Gray Spot Rock

Cottonwood Lake

Slick Horn

Cliff Dwellings

Boundary Butte

Salt Spring

Mesa

Butte

Whitebelly Wash

Water Creek

Lone Mountain Canyon

Mesa White Valley

Lone Wash

WHITE MESA

Red Mesa Pumping Station

Radio Tower

Potato Rock

Red Mesa

NAVAJO INDIAN RESERVATION

SAN JUAN COUNTY, UTAH

APACHE COUNTY, ARIZONA

GtA ShD ShE MoB RRG RO MRE AmB BA AUC SnB BD AtA AsA PY

5 Miles

Scale 1:63360

SAN JUAN COUNTY, UTAH, NAVAJO INDIAN RESERVATION — SHEET NUMBER 18

18

N

(Joins sheet 9)

R. 24 E. | R. 25 E.

R. 25 E. | R. 26 E.

2 720 000 FEET

160 000 FEET

T. 43 S. | T. 42 S.

5 Miles 4 3 2 1 0

25 000 Feet 20 000 15 000 10 000 5 000 0

Scale 1:63 360

(Joins sheet 17)

140 000 FEET

2 660 000 FEET

White Mesa Village

WHITE MESA

Lone Mountain

Lone Mountain Canyon

Rough Canyon

Lighting Rock Creek

Black Rock

Tsitah Valley

Three Gray Hills

Wash

ROCK POINT

SAN JUAN

RIVER

Mesa

Flat

YELLOW

Red Shirt Reservoir

Tsitah

Ruins

Todaston Wash

Four Corners Monument

NAVAJO INDIAN RESERVATION

UTAH COLORADO

SAN JUAN COUNTY UTAH

SAN JUAN COUNTY ARIZONA

APACHE COUNTY

SAN JUAN COUNTY

SAN JUAN COUNTY

SnB WhB BA BD AmB ShD WkB AV NaB ToB AtA AsA